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*Illustrated.

The Engineering and Mining Journal

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Conservation

"Conservation" for several years has been a word to conjure with. It has been a good word and a good idea, but it has been misunderstood by many well-meaning enthusiasts, and their ill-considered propaganda has done harm.

Conservation, when it means the avoidance of unnecessary waste, is a good thing. If we can reduce the enormous loss of property suffered annually by fire; the enormous loss of labor suffered by unscientific management; the enormous loss of life by accidents resulting from carelessness; if we can economize in these and many other things we shall have real conservation.

Conservation, when it means that natural resources be reserved in order to prevent what is called "overproduction" is not a good thing. If we produce such large quantities of coal, copper, petroleum, etc., that competition reduces the price below the production cost of all but the most favored, and absorbs the capital of many producers, there is not fundamentally a waste. Individuals may suffer loss of their money, but what they lose is gained by others. The cheap coal, metals and petroleum are converted into other forms of wealth and the prosperity of the nation as a whole increases.

Consider, for example, the case of Alaska. Would not its industries leap ahead if they were given the advantage of the coal resources that exist there?

Conservation is properly applied to production when the latter is made wastefully. We have had many examples of disgraceful waste in the United States, but in general our production has not been wasteful. The self-interest of producers does not permit unnecessary waste. We are constantly told that in many industries, e.g., the production of zinc, we win only 50 or 60 per cent. of the metal of the ore deposits. In many of those cases an increase in the extraction would be an actual economic loss.

Knowledge enables us to do better and better in all things. That kind of conservation has been practised ever since industry began and is constantly in the minds of the exploiters of natural resources. If we had been compelled to leave those resources untouched until we could extract 95 per cent. of their valuable substance, we should never have learned how.

The superficial ideas as to the practice of conservation have a close connection with the old adage about saving at the spigot and losing at the bung-hole. There is a vast difference between the state regulation of corporations and the limitation of their activity. Thus, if the enormous water-power now going to waste is to be reserved from use for fear that it will pass into the hands of corporations there is the very antithesis of conservation in that waste. If such water rights be conferred upon corporations only for a limited term of years the present generation has got to pay the bill. The corporation must necessarily reckon a relatively brief period of amortization of its capital investment, which of course, must be included in its charges.

We believe that a good deal of the slackness in present business in the United States is due to the political policy, in which ill-considered conservation plays an important part. The adverse economic conditions that produced the troubles culminating in 1907 have been corrected. Europe has regained its position and is enjoying remarkable prosperity. Canada is experiencing something very much like a boom. Industry lags in the United States, though the financial situation is easy. The trouble is largely that our captains of industry do not know what they will be permitted to do. The campaign against corporations and the ill-judged reservation of resources are blights.

We are sufficiently optimistic to believe that a new basis will be evolved. As in all such movements as we have lately been experiencing the day of the blatant demagogue passes and that of the thoughtful reformer comes. Wild proposals give way to a sober program. This

must be so in our case, else we should have to expect the diversion of our own capital to investment in foreign countries where more freedom can be enjoyed.

The Steel Investigation

The Congressional investigation of the Steel Corporation continues to bring out statements from different witnesses which excite public attention and perhaps throw some interesting sidelights on the formation of the trust, but do not, after all, add much to the sum of our knowledge. While some of the details were beyond public observation, the various transactions which preceded and accompanied the formation of the Steel Corporation have been fairly well known. Nor have the methods and purposes of the corporation, since its organization, been secret from general observation.

One of the curious things about the testimony taken was Judge Gary's declaration on the witness stand in favor of government regulation. Everyone knows that the head of the Steel Corporation has always been in favor of a "controlled market," that he believes in the right of the seller to regulate prices irrespective of supply and demand, and to prevent fluctuations in either direction. That he would go so far as to advocate publicly the regulation of prices by a government bureau was something of a surprise. It certainly was carrying the "controlled market" to its limit.

There is not space here to go into the merits of Judge Gary's proposition, or to discuss the consequences which might be involved. We hardly think that it will be accepted by the modern commercial world. It shows, however, to what lengths the belief in the absolute power of associated capital can be carried. That power is very great, but there is still some doubt, and very decidedly some doubt, as to whether it can disregard the old law of supply and demand.

That the investigation has had no effect upon the fixed policy of the corporation to absorb and control raw material supplies, is illustrated by the completion of its purchase of the Pittsburg Coal Company's coke properties which was noted in the JOURNAL last week. The supply of coke is almost as essential to the iron industry as that of iron ore, and this purchase is an important step toward its complete control.

The Cleaning Up of Mining Fakes

In his last annual message President Taft stated that among the policies of his administration was the elmination of fraudulent schemes by get-rich-quick artists to absorb the savings of the people, usually the poor people. In reporting the work of the Department of Justice, he said: "I invite especial attention to the prosecutions under the Federal law of the so called bucket shops, and of those schemes to defraud in which the use of the mail is an essential part of the fraudulent conspiracy, prosecutions which have saved ignorant and weak members of the public and are saving them hundreds of millions of dollars."

The connection between the fraudulent promoter and the bucket-shop operator is a close one. The policy of the administration has comprised the elimination of both. Apparently the work has been nearly completed. A few weeks ago Attorney-General Wickersham announced that more than 400 bucket shops had been put out of business, and that gambling in stocks in many small cities and towns had been entirely stopped. It has been stated to the attorney-general that three-fourths of the alleged brokers' offices in Pennsylvania and in the West and South had, in reality, been conducted as bucket shops before the Government's movement.

The environs of Wall Street have been disinfected of this particular plague as never before. Under the new regime it has not been healthful to introduce the promotions that formerly were so common and the light-fingered gentry have found it safer to turn to other vocations, or at least to keep very quiet. The telegraph companies, feeling the hand of authority, have withdrawn their facilities and a word has been quietly said to the press.

One reason the "millions-in-it" promoters used to thrive was that they had no difficulty in buying all the space they wanted in the big newspapers. All some newspaper business managers cared about was the color of the faker's money. The only two sure winners in the 'get-rich-quick" game were the "fiscal agents" and the newspapers that took their advertising for cash. There wasn't much difference in the morals of the two sure-money ends of the game. But certain newspaper proprietors were quietly informed by persons in authority that it might be well for them to establish a censorship of their financial advertising.

This, of course, cut at one of the main roots of the evil. It had been pointed out emphatically by Governor Hughes' committee on speculation that the newspapers engaged in circulating the advertisements of fraudulent promoters were largely responsible for what followed. Everyone knows what element of the press has done this and why; but few, perhaps, know the magnitude of the illicit profit. It is not too much, however, to say that the press has been one of the chief partners. If charged with complicity some might affect innocence, but who looks for green in the eye of a manager of a great daily? And who would credit him with not knowing an ad. that was not on the square?

Some time ago, when two notorious "promoters" were languishing in jail in default of bail, people asked how it was that such persons could not themselves supply the necessary money if they had gathered in so much as reputed. In fact, the huge proceeds were distributed about as rapidly as they came in. These "promoters" were generally high livers, the conduction of their business was extraordinarily expensive in the ways of rent, salaries, telegraphing, etc.; and the disbursements for advertising were enormous. One concern, just before it was "pulled," had closed a contract amounting to $330,000. Another had incurred bills that were staggering. This was where the daily press came in. The "promoters" played for the day when they could get away with a fat bank roll. The suckers furnished the money. Legitimate mining suffered from the disrepute that became attached to the whole industry.

Some of our financial contemporaries seem to enjoy reporting to their readers the glad news that "all of the leading copper sellers have now sold out," which by implication is a warning to consumers that they would well be careful or they may fail to get their needed supplies except at famine prices. We wonder what the experts who pen such remarks conceive to be the meaning of the 165,995,932 lb. of accumulated stocks that the producers still report. This does not look like any "sold out" condition or any impending dearth of refined copper.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

Geological Survey Reports

I am sure that many interested persons will emphatically second the criticism made in an editorial in the JOURNAL of May 27 of the U. S. Geological Survey for the seemingly unnecessary delay in issuing district reports.

While the Bingham and Park City reports were slow in being published, a more glaring instance is the monograph on the Butte district, which was supposed to have been written by Walter Harvey Weed. The field work was completed in 1902, but publication was postponed, pending the settlement of the Amalgamated-Heinze litigation, and additional field work was done a year or two later, but, at about the time of Heinze's sale, Mr. Weed informed me that this work was nearly ready for publication and would be issued in a few months. Since then, in response to my letters of inquiry, I have been informed by the officials of the Survey at various times, that this important public document "would be published in a short time."

That the Amalgamated Copper Company, which controls practically all of the known copper-bearing area of the camp, has a most efficient geological department (to whose records Mr. Weed had full access), and needs no information or instruction from the U. S. Geological Survey, which fact may have some bearing on the case; but, there are local property owners as well as engineers and geologists here and elsewhere, who might be greatly benefited by the detailed description and discussion of Butte geology by such an eminent authority as Mr. Weed.

While the Butte monograph cannot be an epitaph, even if it is held back another 10 years, it will be behind the times if it fails to include some account of the recent developments of copper and zinc ores in what was considered exclusively a silver belt at the time of Mr. Weed's earlier work in the district.

"More power to your elbow" if you can stir up enough fuss to cause an untying of red tape and a reasonably prompt issuance of the Survey publications.

ALEXANDER LEGGAT.

Butte, Mont., June 4, 1911.

Rainy Hollow District Alaska

In the JOURNAL of May 20, it is stated that the first shipment of ore from the district of Rainy Hollow, Alaska, was made recently.

In this connection I wish to say that the Alaska Iron Company made smelter shipments in 1907, 1908, 1909 and 1910. In fact, I was the first person to do active development work in that district, brought capital in and caused the Government to construct roads, and so open up that part of the country. Because this development has been done privately and with private capital, it has received little attention.

WALTER S. BROWN.

Seattle, Wash., June 9, 1911.

Topographic Mine Mapping

The article of J. H. Farrell on topographic mine mapping in the JOURNAL of March 25, has inspired the following comments on the methods therein advocated.

In the making of a topographic mine map, it is not economical to use greater refinements in one part of the work than are necessary to keep the greatest probable error in the outlying portions of the map well within that which may be made in plotting. The error in plotting depends upon the scale, the multiplication of an error in base-line measurement on the length of the line, the size of the area mapped and the size and distribution of the triangles. In many cases it will be found that corrections for sag and temperature are not necessary. The same idea applies to the plotting of traverses from the primary triangulation points as with the shorter, sufficient accuracy can be obtained and much time saved by using a good steel protractor reading to 10 min., and not computing the coördinates.

In small scale maps this relation between the accuracy of the data and the accuracy of the plotting is often overlooked, and much time wasted in reducing stadia readings to an unnecessary number of decimal places when a mental calculation would suffice, and not enough time is spent on refinements in plotting. The choice of symbols, for instance, is important. The conventional shaded square for a shaft is good on the final map, but on the field sheets a centered symbol, such as a dot within a square is better, since only then can it be used for tying in side traverses with any accuracy. An x is not good for indicating old workings or openpits, since it gives no idea of size, shape or exact location.

Coördinate axes should not be inked in, as afterward they cannot be used for precise plotting. They should be drawn in once firmly with as hard a pencil as possible, sharpened to a chisel edge; then they will remain distinct enough through two or three months field work. A needle should not be used in setting up at primary triangulation stations unless the usefulness of the stations for plotting traverses is at an end, and a needle should not be used in any case for short sights. A contour pen is difficult of exact manipulation unless the contours are characterless and is not generally used by draftsmen.

In stadia work one computation is saved by taking the hight of instrument and setting the middle crosshair on the same point on the rod when reading the vertical angle.

On the whole it is more convenient to assume an axis of coördinates approximately coinciding with the magnetic meridian, particularly if the plane-table sheet is used as a basis for a geological map, since the coördinate axes and perpendiculars are more useful in rapidly plotting compass and pace traverses in the field, and the necessity of setting off the magnetic variation on the compass is then obviated.

The description of the method of resection is inaccurate: "If the point is not known its location is obtained by the method of resections; the straight-edge of the alidade is placed on some known point on the map and the same point on the ground is sighted, a light pencil line is drawn along the straight-edge about where the observer thinks the point should fall on the map. This is done for three or more points, and the point at which most of the lines intersect is marked as the point on the map." If only three points are sighted it is a little difficult to see where most of them would intersect, and if there are more and three intersect in a point and the others do not, obviously there is an error. The correction of a compass orientation by inspection is difficult and attempts to do it are usually a waste of time. The tracing-cloth method of location is usually to be preferred, though it tries one's temper in windy or freezing weather. In any case three-point or two-point locations should be checked as often as possible, and undeterminate positions or those which give a large triangle of error watched for and avoided.

C. T. BRODRICK.

Kyshtim Mining Works, Russia, May 13, 1911.

Linton B. Sutton

Linton B. Sutton, one of the well known mining engineers of this country, died in New York, after a prolonged illness, on June 11. He was born at East Liverpool, Ohio, September 16, 1866, and was graduated from the Michigan College of Mines in 1889, returning, however, for a post-graduate course, which he completed in 1890. For the next nine years his chief work was in the iron country, save for an outside engagement as mining engineer for the Tremont Gold Mining and Milling Company. In the iron country he was employed as mining engineer and chemist by the Volunteer Iron Company, and later as mining engineer for the Chapin Iron Company. In connection with these companies he gained an important experience in mining on a large scale, including the various applications of the caving system, and achieved a noteworthy esteem as an engineer capable of handling difficult problems and as a thoroughly competent mine manager. This led to his being invited by Thomas H. Leggett to join him in the Transvaal, whither Mr. Sutton proceeded in 1899, taking a place on the engineering staff of S. Neumann & Co. This being the time of war in the Transvaal, when mining at Johannesburg was suspended, Mr. Sutton's first commission was to examine copper deposits in Namaqualand. Completing that work he went to Johannesburg, toward the end of the war, and in course of time became general manager of the Randfontein Deep, Ltd. Upon retiring from that position he was engaged in an important gold-mining investigation in Madagascar, after which he returned to Johannesburg to become assistant consulting engineer, under Fred Hellmann, for the East Rand Proprietary Mines, and for a brief period was acting consulting engineer for that company.

Mr. Sutton returned to the United States in 1907 and entered into general mining practice, but in March, 1909, became assistant to Pope Yeatman, consulting engineer for the Guggenheim Exploration Company, and under him was connected with the development of the Nevada Consolidated, Copper River, Esperanza and other important mining enterprises. In 1910 Mr. Sutton was promoted to the position of consulting engineer for the Esperanza Mining Company, which position he held at the time of his death. During the last six months, and more, Mr. Sutton had been in poor health, and for several weeks had been unable to be active in his work.

Mr. Sutton was a thoroughly lovable man and warmly appreciated in his profession, in which he had many admirers and dear friends. He was distinguished for his modesty, which failed, however, to cloak his professional attainments that were of a high order. Loyal, sincere, unassuming, his untimely death is a real loss to the engineering profession. He was a type of all that is best in mining engineering and its profession.

Utah Salt Lands

SALT LAKE CORRESPONDENCE

The decision in the case of the Montello Salt Company against the State of Utah, regarding the saline lands in Tooele county, which was in favor of the State in the district and State supreme courts, has been reversed by the supreme court of the United States in a decision handed down May 29. Litigation began nearly four years ago. The large natural salt beds west of Great Salt Lake were claimed by the State for the University of Utah under section 8 of the Enabling Act. The Montello company took up the salt lands along the line of the Western Pacific, making its locations on the supposition that the language of the Enabling Act restricted the university to 110,000 acres of the saline lands. The university maintained that the 110,000 acres was simply a basis for selection, construing the grant to mean that it was to have all the saline lands in the State. According to the Enabling Act, two townships were granted the State for establishing the University of Utah, in addition to which 110,000 acres of land, to be selected and located as provided in this act "and including all saline lands in said State" were granted to the State for the use of the university. The decision is based on the grammatical construction of the above clause, and emphasizes the point at issue namely the construction of a phrase with the word "including." The supreme court construed the word to be restrictive and not expansive, maintaining that it was not used with the same meaning as "also," as contended by the State. By the decision the university gets its 110,000 acres of saline lands, the supreme court holding that congress supposed this to comprise all the saline lands, but all other lands are released from its claim.

The 40,000 acres or more of salt nearly pure enough for table use are said to have been discovered in 1905, when surveyors for the Western Pacific were running a line across the desert. The stake drivers complained of a hard upper surface, through which it was nearly impossible to drive the stakes. Beneath this upper crust the men found beds of almost pure salt. According to some, however, the deposits were known previous to this time. The area is supposed to have been covered by a part of Lake Bonneville at one time, but there are some salt springs on the western side of the deposit, and the beds may have had their origin in part from this source, inasmuch as there is little sodium sulphate in the beds, compared to that which is present in the waters of Great Salt Lake.

Various estimates have been placed on the value of the deposit. The depth of the salt is from 2 ft. to 15 ft., with an average of possibly 3 ft. The material could be mined by steam shovel, and as it is from 96 to 99 per cent. pure, would require little or no refining. The value has been placed as high as $200,000,000, though probably this is much overestimated, on account of the difficulty of getting the salt to a market that would take it in large quantities. There are at present enough salt works on the shores of Great Salt Lake to supply the local demand, these companies producing salt very cheaply from the lake water by solar evaporation.

The Montello Salt Company was formed in 1906 by 1000 locaters, the greater number being from Ogden, Salt Lake, and Nevada. In 1910 the capital stock was increased to include about 1000 more locations. Each locater was allowed 600 shares of stock, representing 20 acres of salt land. For every 600 shares issued 400 shares were put in the treasury, to meet expenses of exploitation and development. Under the injunction of the Utah courts, the property has been left undeveloped, and the Salt company was not only restrained from proceeding with any work, but was released from the obligation of making the yearly improvements required by the placer law, under which the lands were located. Since the decision of the supreme court, 20,000 shares of stock have been advertised for sale at 75c. per share, the first half of which was sold in two days.

Coniagas Report for 1910

The annual report of the Coniagas Mines, Ltd., of Cobalt, Ont., for the year ended Oct. 31, 1910, states that the production for the last year was 1,929,531 oz. of silver, of which 949,901 oz. were contained in concentrates and 979,630 oz. in ore. The total shipments were 975 tons.

The capacity of the 60-stamp mill is 160 tons per day. The stamps weigh 1250 lb. each; during the year the installation of stamps was doubled. A total of 33,539 tons of ore was crushed.

The ore reserve at the end of the fiscal year was estimated at 127,167 tons, containing 15,368,400 oz. of silver. After making a series of tests, it was decided that the system of concentration now employed could not be advantageously displaced by a cyanide process, the tailings from the concentrator not being of sufficient value to warrant further treatment at present.

During the last year $240,000 was paid as dividends, and the company had a cash balance to its credit of $242,900 and $374,087 in ore in transit and at the smeltery. At Christmas the employees received a present from the company, amounting to 4 per cent. of their wages.

The total income for the year was $1,010,414, of which $989,070 was from ore revenue. The working costs amounted to $256,525, leaving a balance of $753,889 as net profit.

Hidden Creek Copper Mine

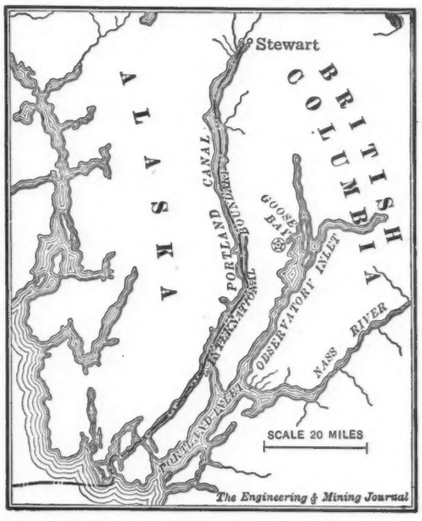
By E. Jacobs*

The officials of the Granby Consolidated Mining, Smelting and Power Company, Ltd., recently returned from a trip of examination of the Hidden Creek Copper Company's mine, situated in the vicinity of Goose bay, British Columbia; the group of nine mineral claims being under working bond to the Granby company, with option of purchase from the New York, Butte and Seattle owners, who, according to report, offer for $400,000 their 80 per cent. interest in the property.

Observatory inlet is a branch of Portland inlet, running practically parallel with Portland canal, the two inlets being about 15 or 20 miles apart. Portland canal is immediately southeast of the most southerly part of Alaska. Observatory inlet splits 35 miles from its entrance into two arms, viz., Hastings and Alice arms, the first heading northward and the other eastward. Goose bay is a large sheltered inlet, its outlet being on the west side of Observatory inlet at the entrance to Hastings arms. The property was visited in the autumn of 1909 by Herbert Carmichael, of the British Columbia Bureau of Mines, and his description[1] is the authority for the data herein given.

The principal work on the Hidden Creek Copper Company's group of mines has been done on the Alpha and Revenge claims; there is an excellent plank road two miles long, extending from the deep water of Goose bay to the main tunnel, 530 ft. above sea level. Prospectors were first attracted by a round-top hill about 1000 ft. high, more or less covered by a typical gossan or iron cap. Prospecting showed this gossan to be thicker and more strongly marked in some places than in others. The first work done proved the oxidized ore to be 5 ft. thick; trenches disclosed a body of mixed pyrite and chalcopyrite ore, which was prospected by four tunnels, aggregating 200 ft. in length. A large body of ore, containing from 4 to 6 per cent. copper, was developed. This place was called Cabin bluff; it is at an altitude of 700 ft. Around the hill, about 500 ft., and 200 ft. higher, a larger exposure of ore was discovered and named Mammoth bluff. This was stripped, and showed a hight of 300 ft. of mixed pyrite and chalcopyrite, containing 4½ to 5 per cent. copper. It was prospected by tunnels, aggregating 350 ft. in length.

According to information obtained last summer the ore zone has been opened for a little more than 2000 ft. in length, and from 200 to 500 ft. in width. Besides 1500 ft. of opencut work, about 1000 ft. of tunneling has been done. This work has opened a large body of copper-sulphide ore, running from 4 to 8 per cent. copper, with some as high as 12 per cent., and assaying $1 to $3 per ton in gold and silver. The ore contains an excess of iron over silica—much of it pure copper and iron-sulphide, high in both iron and sulphur—making it a desirable smelting ore. The ore has been cut for a width of 125 ft. to a depth of between 400 and 500 ft., and it is known to be of good grade to below the 400-ft. level. There is more than 300,000 tons of ore blocked out.



Key Map to Hidden Creek Mine, Near Goose Bay, B. C.

The general manager is quoted as authority for the statement that the underground work and diamond drilling, done by the Granby company, has developed a large quantity of ore, estimated at about 4,000,000 tons. The average copper content is stated to be about 2.5 per cent. Local conditions are favorable to economic mining. It is said that there is an 87-ft. water fall on a small creek 1¾ miles north of the main tunnel, where 600 h.p. is developed by an impact wheel of the Pelton type. This runs an eight-drill compressor and a sawmill, capable of cutting 7000 ft. of rough lumber per day. Transportation facilities are being provided by the construction of 2500 ft. of gravity tramway, and one mile of electric tramroad, on a 0.7 per cent. grade. This will convey the ore to deep water, whence it can be shipped to any of the coast smelteries.

The first payment on account of purchase will fall due June 15, and was formally authorized at a recent meeting of Granby stockholders in New York.

*Box 645. Victoria, B. C.

[1]*Bull.* No. 1, 1909, Mineral Locations, Portland Canal District.

Smelting in Bond

Washington Correspondence

The Treasury Department has sent to Chairman Cox, of the House committee on expenditures in the Treasury Department a complete file of its records in regard to the smelting of ores. This includes a statement of the wastage allowance made at bonded smelting warehouses, copies of the correspondence the department has had with the American Smelting and Refining Company, and with other concerns, copies of the reports made by Professor Hofman of the Massachusetts Institute of Technology concerning smelting wastage allowances at the different plants, and a variety of other data. Practically all of this material is private in character, never having been made public.

It appears that Professor Hofman in his investigations at the various bonded smelting warehouses found that there was a wide divergence in the amount of waste at the various places owing to the different character of the ores. He, therefore, recommended the establishment of the actual wastage at each plant as determined from a scrutiny of the records for three years back. This was in opposition to the wishes of the American Smelting and Refining Company and of other companies which preferred to have the department establish a general wastage allowance which should be applied to all ores and which should take the place of the flat 10 per cent. allowance that had been accorded under the Dingley law. Apparently it was the view of some of the companies at least that this average allowance might be obtained at a figure as high as 35 or 40 per cent. As a matter of fact Professor Hofman's reports showed that the wastage in smelting varied from 5 or 6 per cent. at some plants to over 20 at others. There was also a wide variation of the loss incurred in refining base bullion, the figure running as low as less than 1 per cent. in some cases while in others it was very greatly in excess of that. Probably the most refractory ores studied by Professor Hofman were those which were smelted at Perth Amboy, N. J. These are the Canadian ores and the difficulty with them is due to the presence of large quantities of arsenates. Some plants have stopped smelting these ores on account of the high percentage of waste connected with them.

As a result of a study of the facts in regard to the smelting allowance there seems to be a strong feeling at the Capitol that the Treasury has a tolerably clean record in the matter and that there is not much to criticize except that so long a delay was permitted prior to the establishment of the present smelting allowances. The department has not thought it wise to make public the detailed facts with reference to this smelting question, and it

now seems likely that the committee of investigation will be somewhat inclined to give due weight to this feeling and to refrain from publishing the record. The matter has not been fully determined as yet and there is a possibility that Professor Hofman's reports, together with the full statement of wastage allowances, may be given out. This, it is believed, might cause trouble among the smelting companies, owing to dissatisfaction on the part of those that have been accorded the smaller allowances for wastage. On the other hand the investigation has stimulated the belief that there was irregular work in Congress at the time the Payne-Aldrich law was passed in connection with the formulation of the section relating to smelting in bond and the establishment of wastage allowances. It is considered probable that when the committee reports on this subject, most of what it will have to say on the smelting question will relate to the way in which the section of the act was framed and put through, relatively little attention being given to the regulations of the Treasury intended to carry out the terms of the act.

Determining Copper in Crude and Spent Pyrites

By W. N. Iwanow

Several years ago Lunge published a method for the determination of copper in raw and in spent pyrites, which gives good results, but is rather wearisome and wasteful of time. For this reason many attempts have been made to supplant this method by a simpler one, e.g., by direct extraction of the copper by means of nitric acid and determination of the metal by electrolysis. This method is, however, inexact, as part of the copper always escapes extraction.

In the following I will describe[1] a new method contrived by me, which is much quicker without losing in exactness. In 1891 Gröger pointed out that in heating FeS_2 with pulverized metallic iron, iron monosulphide will be formed. But, strange to say, nobody paid any attention to the fact that spent pyrites which are hard to dissolve in aqua regia will, after heating with metallic iron, become easily soluble in HCl by forming monoxide compounds ($Fe_2O_3 + Fe = 3\,FeO$). In consequence the copper present may then be separated and determined without much trouble.

On this basis I proceed as follows: Three grams of finely pulverized crude or spent pyrites are mixed with an equal quantity of powdered iron (*ferrum hydrogenio reductum*) and put into a china crucible or preferably into a tube of thin glass, about 3 in. long by 5/8 in. in diameter, closed at one end and open at the other. The mixture is covered with a thin layer of iron and the tube heated for a few minutes over a Bunsen burner to a red heat. It is then placed with its contents into an Erlenmeyer flask holding 250 cc. and a few drops of water squirted on it, when it will burst to pieces. After cooling, 50 cc. HCl are poured in and the flask is heated on the water bath until the fused mass is completely dissolved, which will take about half an hour. As H_2S is freed in this operation, the copper is partly precipitated. Then the solution is diluted to 200 cc. and a vigorous current of H_2S passed through it. The precipitate of CuS is filtered off with other impurities, annealed and dissolved in HNO_3. The iron is precipitated with ammonia and the copper determined electrolytically. The copper sulphide may also be dissolved directly on the filter with HNO_3, the solution neutralized with ammonia and electrolyzed.

COMPARATIVE COPPER ASSAYS BY VARIOUS METHODS

Lunge's, Per Cent. Cu.	HNO_3 Extraction, Per Cent. Cu.	Iwanow's, Per Cent. Cu.
0.69	0.56	0.70
1.35	1.15	1.30
0.91	0.80	0.96
0.80	0.70	0.78
0.89	0.77	0.93

In giving the comparative results of some copper determinations in spent pyrites of Spanish origin by three different methods, it may be remarked that check assays by the new method always agreed exactly, while in the other two methods differences of at least 0.05 per cent. could be observed.

[1]*Chem. Zeit.*, May 18, 1911.

Mines at Gowganda

The following is a list of the mines actually being operated in the Gowganda camp, Ontario. All these mines now have power plants. There are also several companies that are not mentioned, which have been operating in the past and expect to resume operations in the near future, especially if the Government can be induced to better transportation facilities.

At Gowganda are: The Millerette Silver Mining Company, Garney-Thompson Mining Company, Transcontinental Mining Company, Boyd-Gordon Mining Company, Hudson Bay mines, Miller-Lake-O'Brien mines and Northern Mining Company. At Wigwam postoffice are: The Calcite Lake Mining Company, Bishop Silver Mines, Ltd., and the Ottawa-Gowganda Mining Company.

Sons of Gwalia

The Sons of Gwalia, in West Australia, had a prosperous year in 1910, the net profit increasing from £80,000 to £112,000, and the dividends from 19 to 30 per cent. on the 325,000 one-pound shares. The tonnage treated was 162,000. Not only was there an increase of 3000 tons, but the grade of ore improved from 32s. 7d. to 34s. 11d. The value of 69,323 oz. bullion was £294,607. The total cost, including £33,000 for development, was 20s. 2d. per ton. The reserves are now estimated at 3½ years ahead of the mill, irrespective of several shoots of profitable ore only partially developed. The main incline shaft has been sunk to a depth of 2503 ft. Acting on the advice of Geologist Malcolm Maclaren, seven new leases were "pegged" to protect the shoots of the eastward dip.

The Jones Process at Republic, Mich.

Special Correspondence

The Jones process of treating flue dust has been casually mentioned from time to time in the Journal, announcing the initiation or progress of experiments.

The development of the process has been carried on to such an extent that several new furnaces are now being installed at the Kloman mine, at Republic, Mich. Initially, flue dust from the Zenith furnace at Duluth will be treated, and by July 1 it is expected that at least one furnace will be ready for operation.

In the Jones process, the flue dust is made into briquets with lime as a binder and which also takes care of the silica. The product of the furnace is a substance that looks like hard, tough, metallic iron in massive form. It is difficult to break by sledges and a hacksaw or file makes little impression. It contains 61 per cent. iron and keeps the burden in the furnace open to the desired degree.

The outlook for the successful establishment of the process is promising from the technical point of view, but it is now necessary to demonstrate that the capacity of the furnace will permit of its profitable utilization.

Calumet & Hecla Decision

Judge A. T. Streeter, of the Houghton county circuit court, in refusing to grant the injunction asked by the Denton-Chadbourne interests and dissolving the restraining order, maintains that the petitioners had a right, under the law, to examine the property of the corporations without any warrant from him. That the consolidation was not prohibited by the law, that the statute in Michigan covering same had been in effect since 1871; that the statute permitted consolidation by a three-fifths vote of the shareholders; that one mining corporation was permitted to buy shares in any other mining corporation and that a director of Calumet & Hecla had a right to vote the Ahmeek stock owned by the company at the Ahmeek meeting. The court also stated that a continuation of the restraining order would be a gross injustice to the shareholders in the other corporations.

Details of Practical Mining

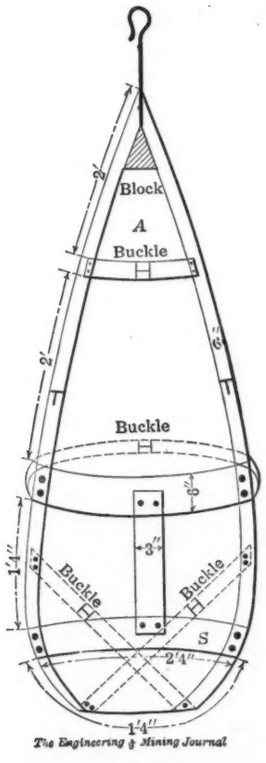
This department is designed to treat in a brief way of details of everyday practice. Many readers are doing interesting things in mining and milling that other readers like to know about. The thought that there is nothing new in them should not be a deterrent of telling about them. Something that is an old story in one district may be quite unknown in another. Our draftsmen can develop any kind of a pencil sketch that is intelligible. A blueprint answers all the purposes of the engraver. Contributions are solicited.

Notes of Interest to Prospectors and Operators of Small as well as Large Mines Things that have to be done in Everyday Mining

Harness for Lowering Mule Down a Shaft

BY W. F. BOERICKE*

Where there is no incline by which mules may be taken underground, the animals must be lowered either in a specially constructed mule cage, or swung down by means of a harness similar to the one here described. Wherever conditions are right, the preference should be given to the harness. The mule cage is heavy, cumbersome, difficult to get the mules into, and means a loss of time in getting the cage in and out of the shaft. To swing a mule with a harness is by no means as formidable a job as it appears at first. The harness itself is a simple affair, and can be made at the mine, out of pieces of old canvas or rubber belting, securely riveted together. The dimensions given in the sketch are adapted for a 900-lb. mule. The harness, when fitted on the mule, should be fairly snug, but the straps should not be buckled too tightly. If the mule is accustomed to harness, he will allow it to be put on without trouble. The parts lettered *T T* should come a trifle below his sides. The part *S* should be low enough to insure that the mule will be seated firmly when he is swung into the shaft. The head and neck, of course, come through the space *A*.



HARNESS FOR LOWERING MULES

When all is ready, the mule is led to the collar of the shaft, and a heavy chain attached to the hook, and made fast to the center of the cage. Planks should be laid across the shaft, so that as the mule is raised, his feet will not catch in the timbers. The signal is given to hoist slowly, and the astonished animal is swung out over the shaft, bearing a marked similarity to a dog begging. The planking is then removed, and the cage slowly lowered. If there are bad places in the shaft, it may be well to tie the feet together, but this makes a delay at the bottom, and is usually unnecessary. When the mule is near the bottom, a rope is tied to the back of the harness, and the animal drawn to one side, so that he lands on four feet. In an actual case, from the time the mule was swung into the the shaft, until he was led to the stables at the bottom, was six minutes, the shaft being 150 ft. deep.

*Mineral Point, Wis.

Loading Bin for Skips

BY L. E. IVES*

In many mines producing a large quantity of ore daily, it is essential to economic hoisting, to expedite the loading of skips to as great an extent as possible. The loading bins illustrated in the accompanying sketches are in use in an inclined shaft where it has been found that the system promotes maximum efficiency enabling all the hoisting to be done in a fraction of the time required by the usual methods formerly employed.

A vertical cross-section longitudinally through the shaft is shown in Fig. 1; *D* and *F* show two plats of ordinary dimensions, while *E* shows one that is cut deeper into the hanging wall than the other two.

The skip is shown at *B* with the bail in place and hoisting rope attached. Between plats *E* and *F*, the hight of the shaft from foot to hanging wall is considerably increased. This increased hight is continued down shaft as far as possible, but leaving sufficient room above plat *F* for an operator's stand *Q*. After this is done, timbers are placed to carry the floor *P* of the bin.

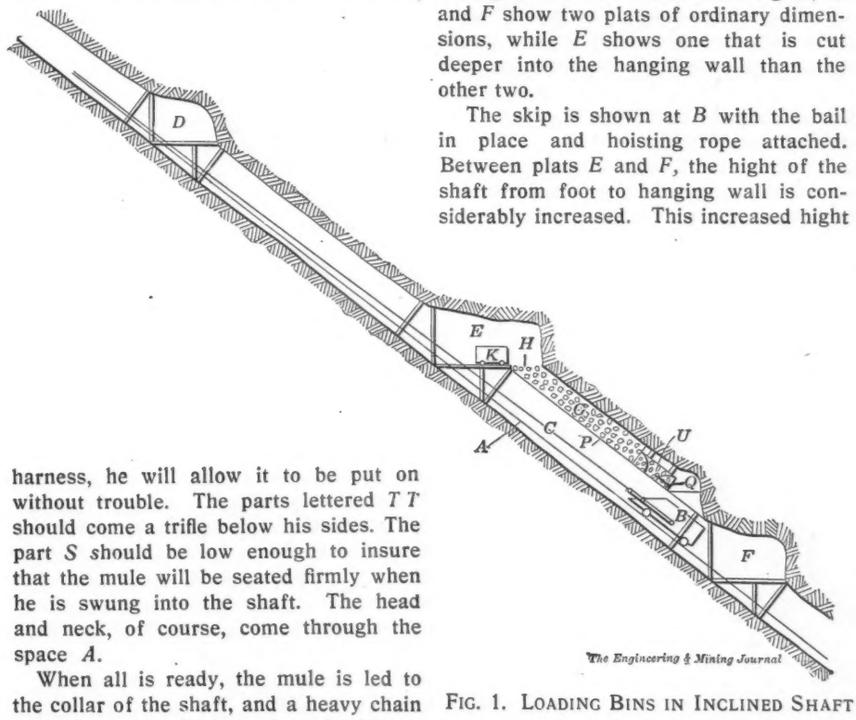


FIG. 1. LOADING BINS IN INCLINED SHAFT

The most important part of the device is the skip-loading pocket *U*. The bin itself is one large compartment, extending entirely across the shaft. The load-

*Mining engineer, 322 Lumber Exchange building, Minneapolis, Minn.

ing pocket is really a part of the bin proper; it is divided into two compartments, one for each skip-road and separated from the bin at the upper end of the pocket by counterbalanced sheet-iron gates. The lower end of the loading pocket is also provided with similar gates. The gates at both ends of the loading pockets are operated with levers from the platform *Q*. Each loading pocket holds one skip-load only.

The mouth of the bin is shown at *H*, at the back of the plat *E*, and *K* represents a car ready to be dumped into the bin. The mouth of the bin is laid crosswise with railroad iron to serve as grizzlies. The oversize is broken by the trammers until small enough to pass into the bin. The operation of loading the skip is performed by a man stationed at *Q*. The upper gates of the loading pocket are opened and the pocket allowed to fill by gravity. The gates are then

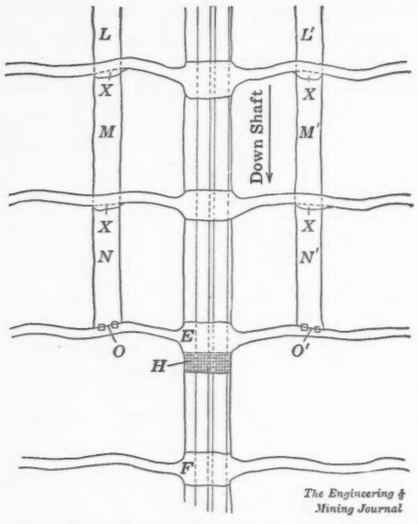


FIG. 2. LAYOUT OF WINZES AND SKIP-LOADING BINS

closed. When the skip comes to rest at the proper position, the lower gates are opened, and the skip is filled and hoisted. The loading pocket is immediately refilled so as to be ready for another skip.

A horizontal plan of the shaft and several drifts, is shown in Fig. 2; *L* and *L'*, *M* and *M'* and *N* and *N'* show a system of winzes which are holed through from one level to another at such grade that the ore will run. The series of winzes on both sides of the shaft are connected with one another underneath the floors of the drifts so as to form continuous chutes at an equal distance on each side of the shaft which terminate at the bulkheads *O* and *O'*, at the level *E*, where the mouth of the bin is situated. These bulkheads are provided with unloading chutes. At the places where these winzes pass under the floors of the several levels, there are openings where rock or ore from that level may be dumped. The ore from the various levels is dumped into the winze, and continues by gravity through the winzes until the lower level and bulkhead are reached. From here it is trammed by an unusually large tram car, to the mouth of the bin. In the most highly perfected form of this system there would be two winzes, one on each side of, and sloping, toward the shaft. These would start at the level *D* and terminate in the bin at *H*. In this event, winzes *N* and *N'*, would not be cut but their places would be taken by the two above mentioned. This would further eliminate handling the ore from the bottom of the series of winzes to the mouth of the bin. This system of loading and hoisting has been used and found to fulfil its object.

Coating for Iron Roofing

BY EDGAR HALL*

In the JOURNAL of March 4, there is a receipt for a paint mixture for coating galvanized iron that is used in the tropics. A much simpler and cheaper coating consists of refined coal tar, one of the varieties of black varnish of the tar distillers. This coating adheres strongly, is elastic and lasting. I have a roof over a reverberatory furnace so coated, which has been in constant service for 13 years, and is apparently as good as ever; an untarred roof over another similar furnace, wore out several years ago.

It may be said the black color is unsightly; but I have found that the black roofs are a relief to the eyes in the excessive glare of the sunshine. In factory buildings the color does not matter, but a black roof on buildings the walls of which are painted in brighter colors, has rather a pleasing effect; it removes the dazzling effects of the corrugations of the iron. After a few showers the rain water does not taste of tar, and, where sulphur fumes abound, no longer contains zinc.

I have also found that red iron-oxide paint can be used over the tar, if desired, but I do not know how the sulphurous rain would affect it. Ordinary coal tar will not answer; the tar must be free from tarry acids and alkaloids.

Smokestacks for Natural Draft†

BY M. E. HARRIS

To solve the problem of correct dimensions for a power-plant stack it is first necessary to approximate as closely as possible the capacity of the plant based on the commercial evaporation. Then if there is the least probability of any increase in the demand for power, make proper allowance for such increase and do not be afraid to err a little in favor of bigness.

After the horsepower capacity of the plant has been determined a simple and easily remembered rule for proportioning the stack is to multiply the number of horsepower by 6. This will give the area of the stack in square inches. Thus, a 500-h.p. plant requires a chimney with an area of 3000 sq.in. This would equal a circular stack of about 62 in. diameter. A comparison with stacks already built will show that this figure is approximately correct.

The hight of a chimney is sometimes governed by local conditions, such as the hight of the building to which it is attached or the hight of surrounding buildings. The ratio of hight to diameter may be from 20 to 36 diameters of a circular stack or lengths of one side of a square stack.

One rule establishes the hight of the stack at 25 diameters. This would be correct for some sizes, but would not apply to all. The hight of the larger chimneys must be limited to keep down the cost of construction, and the hight of smaller stacks must be sufficient to give draft enough to maintain the desired rate of combustion. Thus an 8-ft. stack multiplied by 20 gives 160 as the proper hight, and a 2-ft. chimney multiplied by 36 gives 72 ft. as the hight.

Stability or resistance to wind pressure is secured by constructing the base with an outside diameter equal to one-tenth of the hight.

Automatically Discharging Bailers

BY W. H. STORMS*

Many mine managers prefer bailing to pumping water from mines, and undoubtedly there are situations where bailing is less expensive than pumping. The accompanying sketches show two types of self-dumping bailers; one a cylindrical valve bucket, the other a skip fitted with a hinged valve which opens to admit the water when the skip sinks in the sump. Both are arranged to operate in inclined shafts. The automatic-discharge features will be appreciated by those who have had no experience with bailers of this kind.

An illustration shows the steel barrel on the skids *S* and also its position by means of dotted lines, when discharging. This is accomplished by cutting out a section *A* of the skids upon which the bucket slides. This section is supported on a pivot *B*. A counterweight *W* holds the section in place when the bucket is below, or even when resting upon it when empty, but when it is drawn up out of the shaft filled with water the excess of weight of the bucket and the water below the pivot, as compared with that above it, causes the loose section of the

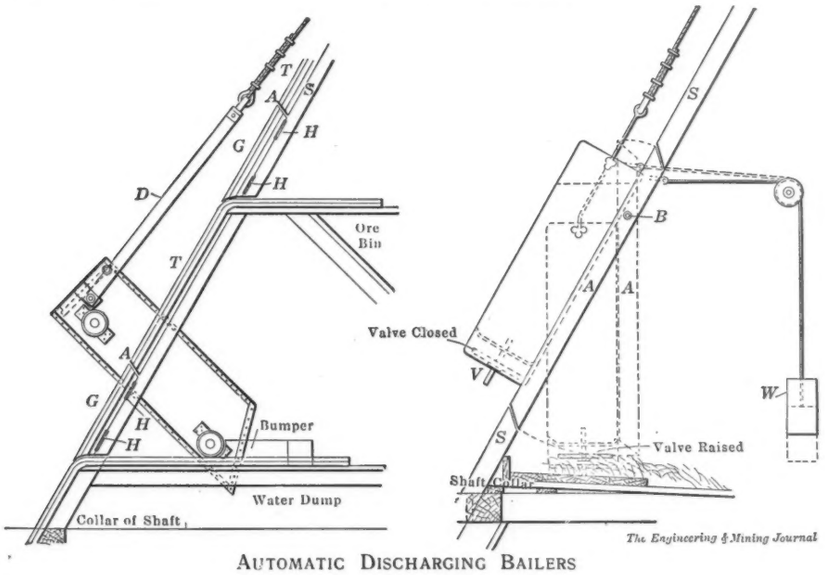
*Managing director, Silverspur Mining Company, Silverspur, Queensland, Australia.

†*Power*, May 10, 1911.

*Mining engineer, 2437 Hilgard avenue, Berkeley, Cal.

skids to swing backward into the vertical position indicated by the dotted lines. The engineer then lowers the bucket without leaving his station at the engine, until the valve spindle *V* rests upon the floor, which forces the valve upward, thus allowing the water to escape and flow away. The engineer then raises the bucket slowly and the counterweight *W* pulls the skids, with the empty bucket upon them, back into position and the bucket is lowered again into the shaft. Necessarily the counterweight must be so adjusted as properly to perform its function. If it is too light it will fail to pull the empty bucket back into position; if too heavy, the full bucket will not tilt the loose section of the skids into vertical position. Ordinarily, buckets are pulled to the top of the skid-way, and there discharged in the same manner as here shown, that is, by the bucket being lowered upon its spindle; but when it is empty a man must be at hand to swing it out upon the skids again before it can be lowered again into the shaft. The automatic device here described therefore saves the labor of one man for a portion of the time at least.

The other illustration shows an ordinary water-skip with a hinged valve in the bottom. The track, generally of T-rail, *T*, is spiked to stringers *S* in the headframe, and dumps provided for both ore and water by cutting out sections of the stringers and track and making gates *G G* as shown. The gates swing on the hinges *H H*, that for the water-dump being about 3 ft. above the collar of the shaft. When a skip is to be dumped the proper gate is opened and upon the arrival of the skip at this point the forward wheels follow the curved rails and run out upon the horizontal track, as shown in the sketch. The engineer continuing to hoist slowly, the lower end of the skip is lifted from the main rails and its contents dumped. There is one thing to be carefully avoided in operating this device. When the skip is approaching the dumping place the hoisting speed must be slackened to a moderate rate or the forward wheels are liable to collide with the upward extension of the track at *A*, thus doing serious damage to the headframe, or parting the cable. I know of one mine where the latter occurred, and the 500-gal. skip rushed 1200 ft. to the bottom of the shaft, where it was hopelessly wrecked. The bumper keeps the wheels from running so far forward that the skip will not automatically descend the shaft again when empty. By having a movable bumper, however, the water-skip can be run in on that dump and secured there by dropping a piece of light timber between the rear wheels and the skids. The cable can then be detached and made fast to the ore skip. In this way either ore or water may be hoisted in the same shaft compartment, by using two suitable skips.

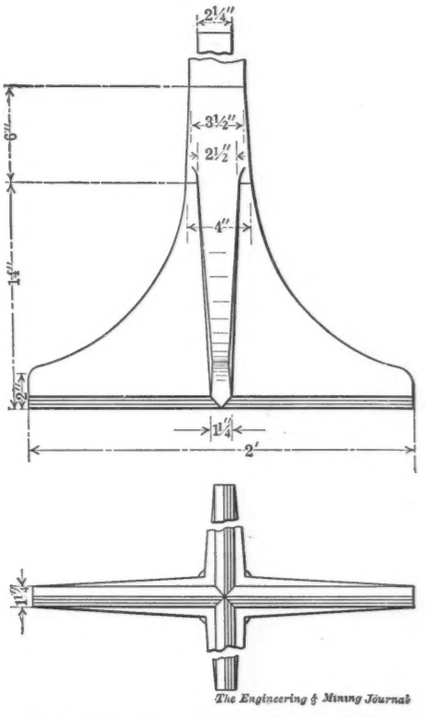


AUTOMATIC DISCHARGING BAILERS

When a shaft is making much water, skips or buckets are unsuited to handling the water when sinking. At such times a pump should be used; but when the shaft is to remain for a long time at one level the water will collect in the bottom, and from this sump the water may be bailed with either valve-skip or bucket. If either bucket or skip be lowered into the sump too rapidly it will have a tendency to float and this may cause the wheels to leave the track, or the bucket the skids. In either event there will be trouble when the hoisting engine is started, as the skip or bucket is sure to catch in the timbers. To prevent this difficulty, two or three planks can be spiked to the timbers at the water level (extending both above and below it several feet), forming guides, and these will prevent the skip or bucket from riding, thus obviating the probability of breaking a cable or doing some other serious damage at the bottom of the shaft.

Cutting Hitches with Large Bits

In building the No. 10 dock of the Pennsylvania Company, in Ashtabula Harbor, Ohio, certain posts were to be set 4 ft. in the solid bedrock 27 ft. below mean lake level. According to *Eng. News* of May 18, 1911, the holes in bedrock were cut by three Ingersoll-Rand drills that had been used in drilling 2-in holes. These were rigged with cross bits as shown in the accompanying illustration to drill 24-in. holes; the length of cutting edge was 24 in. from out to out. A small jet-pipe leading into the hole was used to wash out the cuttings.



DRILL BIT WITH 24-IN. CUTTING EDGE

The successful use of such a large bit is interesting to miners, inasmuch as it suggests trying similar or perhaps smaller bits for cutting hitches for timbers. It might be difficult to use so large a bit for drilling horizontal holes, but for hitches of ordinary size considerable time might be saved by using a 10- or 12-in. bit.

At the Indiana Harbor plant of the Inland Steel Company recently, two 62-in. Cutler-Hammer lifting magnets unloaded 4,000,000 lb. of pig iron from a steamship in 10½ hours. The maximum number of lifts made in an hour was 73 and the minimum 45. In all 1281 lifts were made by the two magnets used, the average lift per magnet being 3427 lb. With the lifting magnets only two or three men are needed in the hold of the vessel, and no time is lost in filling buckets.

The Zinc Corporation and the Flotation Processes

At the annual meeting of the Zinc Corporation in London last month, F. A. Govett and H. C. Hoover, the joint managing directors, made statements respecting the experience of this company with the Elmore and Minerals Separation flotation process, touching upon the matter of the litigation involved. The Zinc Corporation has been using the Elmore process, but lately has abandoned it in favor of the Minerals Separation process.

Mr. Govett said: "When I was at Broken Hill last year we had installed a Minerals Separation unit which practically showed us that all classes of material could be treated satisfactorily by this process. At that time it was the idea of Mr. Mitchell that the Minerals Separation process was more flexible; that the Elmore plant would not be able to cope with the admixture of slimes, the necessity for which was rapidly becoming imminent. Had it not been for two things, namely, the legal position and my own sense of fairness, we could at once have done what later we did, i.e., erect a Minerals Separation plant and work the two processes side by side on different classes of material. But the trouble was that this did not get rid of the legal position set up by the action of the Minerals Separation people, which, wholly unjustifiable as I have always regarded that claim and action, was still a danger, in view of the toss-up nature of any decision in a court of law. I spent a weary time in trying to smooth out the legal difficulties, but wholly failed. Later we opened up negotiations with the Minerals Separation people with the object of disposing of the legal position, and finally arrived at an agreement. They were to show us that their process was as good as the Elmore on the various classes of material; if done, we were to adopt the Minerals Separation process throughout as soon as it could be installed; they were to abandon all legal claims against us and were to guarantee us against any damage for action or infringement of patent. We were to pay a sum for legal expenses, etc. This payment I do not pretend to be able to justify. In my judgment the claim was monstrous, but there are occasions when it is better to pay such claims, and I think this was one. Frankly, had we been forced to defend the Minerals Separation action, I do not think we should have lost, any more than I think we should have lost an action for infringement from the other side; but always I return to the uncertainty of decisions in a court of justice. Apart from that, I have not leisure to spend on this time-and-energy absorbing litigation, and I admit I made the payment to avoid a threatened law suit."

Mr. Hoover said: "Now, as to the change in processes. I do not know whether you fully understand that all these processes are what are called flotation processes, and the underlying idea and principle of them is very much the same. This principle was known and was used before those who are the present owners were in business at all. On the other hand, they have wrapped them up with a mass of patents, litigation and other things, which make it very costly to get through them in Australia.

"The result of our working since we began to make the alterations shows that we can now work down to 2 per cent. residue; in other words, the tailings from our mill run only 2 per cent. zinc. For the last three years they have run 4 per cent. Therefore, we are obtaining a better extraction with the altered process, and it looks to us as if we will be able to reduce our working cost somewhere from 1s. to 1s. 6d. per ton. The credit for this is not entirely due to the Minerals Separation Company or the process, but it is due to our own staff, who have made a mechanical success out of this method of working."

The Rankin Process

A new process for the treatment of all classes of ores is that of H. D. Rankin. This consists, for sulphide ores, in a treatment with nitric acid, which converts the sulphides into sulphates. The nitric-oxide fumes are converted by atmospheric oxygen to nitrogen peroxide and passed, under pressure, with excess of oxygen through a crushed-quartz tower through which water flows, which it is alleged, results in a 98 per cent. recovery of the nitric acid. The sulphate solution is treated by various chemical or electrochemical methods, according to its metal contents. Thus silver or mercury is to be precipitated as chlorides, and then reduced to the metal; or silver may be thrown down on copper plates; copper can be recovered by electrolysis with insoluble electrodes, by precipitation on scrap iron, or by precipitation as carbonate. Gold, no matter in what form it occurs, is said to be left amalgamable.

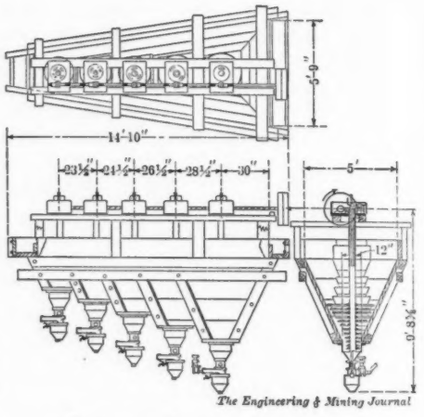
In case there is a slight deficiency in sulphur in the ore, enough sulphur or pyrite is added to give sulphuric acid enough for complete solution of the metals as sulphates. In the case of a carbonate or oxide ore which would consume too much acid, solution is effected under pressure by carbonic acid, forming bicarbonates.

The insoluble residue containing gold, lead sulphate, etc., is passed over amalgamation plates and the gold recovered; then over a concentrating table, and the lead sulphate "separated from the silica by sliming." A commercial mill has lately been erected at Lake City, Colo., to demonstrate this process.

The Richards-Janney Classifier

This classifier is made up of a series of rectangular compartments of successively increased size and stepped down gradually from the feed end. The combination of side inclination and stepped-down successive compartments creates a division between each two compartments. The lower part of each compartment is lagged to the form of a frustum of an inverted cone and constitutes the settling chamber. Attached to the bottom of each compartment is a cylindrical sorting chamber, the lower end of which is attached to the hydraulic chamber. Between the hydraulic and sorting chambers is a well protected glass sight tube.

The hydraulic chamber is in the nature of a tee of rectangular section and is tapped for the hydraulic inlet. This inlet is governed by a gate valve with an indicator, showing the position of the valve. The bottom of the hydraulic chamber has



RICHARDS-JANNEY CLASSIFIER

a large flanged end, tapped to receive the inner valve-seat bushing. Attached to this flanged end is an inverted cone-shaped retarding chamber, the apex of which is tapped to receive the outer bushing. The retarding chamber is provided with an air cock.

A vertical sideboard extends the full length of the classifier on top, the feed inlet and overflow outlet being a few inches below the top of the sideboard. Above each compartment and well supported by framing is a cast-iron box with housing for the driving mechanism. The bearing for the spindle is securely attached to the base of the bar and extends downward through the supporting frame. The spindle is hollow, extends downward into the center of the sorting chamber and carries a series of sorting blades. A worm wheel is riveted to the upper end of the spindle and engages with a worm on the main horizontal shaft. Cams are attached on top of the worm wheel to raise and lower the valve rod intermittently.

The valve rod extends through the hollow spindle, and is fitted at the lower end

with a rubber valve, which seats on the inner bushing in the hydraulic chamber. A bushing in the upper end of the spindle holds the valve rod central. An arm is fitted to the upper end of the valve rod and in engaging with the cams on the worm wheel, opens and closes the discharge valve.

The ease of the replacement of parts is a feature of the classifier. The valve rod can be removed entirely. The spindle or sorting-blade shaft can be raised out of its compartment and blocked up for internal inspection. The inner bushing can be reached easily by removing the retarding chamber.

The worm shaft revolves from 80 to 90 r.p.m. The hydraulic water is turned on, the feed enters the classifier, the sorting-blade shaft turns and loosens the pulp without any raising or lowering action. The cam raises the valve rod, opening the valve, releasing the material through the inner bushing into the retarding chamber. The retarding chamber fills with sand, and the valve rod drops, closing the inner bushing. The material flows steadily from the retarding chamber, through the outer bushing, and when the chamber is empty, the classifier is ready for the next cycle.

These classifiers are being made by the Allis-Chalmers Company and have been installed at the Magna and Arthur plants of the Utah Copper Company, at the Ray Consolidated and the Little Bell mills.

International Smelting Report

The report of the International Smelting and Refining Company, operating a smeltery at Tooele, Utah, and the Raritan Copper Works at Perth Amboy, N. J., covers operations for the five months ended Dec. 31, 1910. The Tooele smeltery was completed in July, but the amount of ore received has not been up to expectations, especially in regard to the ore received from the Utah Consolidated mines, so that the plant has been operated only at about half capacity.

During the period of operations, 63,386 tons of materials were smelted, from which were produced 2,431,317 lb. of copper, 87,153 oz. of silver and 3930 oz. of gold. The income for the year was $2,636,932, the costs $1,634,741, of which $226,360 was allowed for depreciation. The balance was carried forward. The capital of the company is 100,000 shares each of $100 par value.

Lead furnaces are being erected at the Tooele plant, and a lead refinery will be built at Perth Amboy. The lead smeltery will have a capacity of 500 tons of ore per day, and should be running at full capacity before the end of the year. Contracts have already been made for sufficient ore to insure a full supply. These improvements will be paid for from cash on hand and earnings, and no further stock issue will be made for this purpose.

Owing to curtailment in copper production, the Raritan refinery was not run at full capacity during 1910, and consequently earnings suffered. New refining contracts have lately been made, and in consequence earnings this year should increase, irrespective of any additional tonnage from old contracts, due to a better copper market.

British Iron and Steel Production

The British Iron Trade Association has published its report for 1910, giving the production of iron and steel in the United Kingdom. The production of pig iron is the largest ever reported for a calendar year; but the make of steel fell below that of 1907, and below 1906 also.

Pig Iron Production

The make of pig iron in Great Britain for the first half of 1910 was 4,993,745 long tons; in the second half it increased to 5,223,000 tons, making the total for the year 10,216,745 tons; an increase over 1909 of 552,458 tons, or 5.7 per cent. The nearest approach in previous years to the total of 1910 was in 1906, when 10,149,388 tons were made.

The production of pig iron according to the uses for which it was intended was, in long tons:

	1909	1910	Changes	
Foundry & forge.	4,323,241	4,098,320	D.	224,921
Hematite (bessemer)	3,559,773	3,892,533	I.	332,760
Basic	1,449,862	1,875,834	I.	425,972
Spiegel and ferro	308,719	321,412	I.	12,693
Unclassified	22,692	28,646	I.	5,954
Total	9,664,287	10,216,745	I.	552,45

Included in the foundry iron in 1910 were 152,373 tons of direct castings. There were 473,896 tons of hematite and 1,223,265 tons of basic pig—1,697,161 tons in all—charged directly in a molten state from the blast furnace to the converter or openhearth furnaces. This was an increase of 316,045 tons over the iron similarly treated in 1909, when this molten iron was first reported. The increase in the production of 1910 over the previous year was entirely in steel-making irons, foundry and forge iron showing a decrease.

Steel Production

The production of steel ingots in Great Britain for two years past was as follows, in long tons:

	1909 Tons	1909 PerCt.	1910 Tons	1910 PerCt.
Bessemer	1,733,220	29.5	1,779,115	29.6
Open-hearth	4,148,408	70.5	4,231,569	70.4
Total	5,881,628	100.0	6,010,684	100.0

The increase in bessemer or converter steel in 1910 was 45,895 tons; in open hearth 83,161; the total gain being 129,056 tons, or 2.2 per cent. The total was 715,042 tons greater than in 1908, but was less than in 1907 by 512,064 tons.

The division into acid and basic steel is as follows, in long tons:

	Acid	Basic	Total
Converter	1,138,103	641,012	1,779,115
Open-hearth	2,653,033	1,578,536	4,231,569
Total	3,791,136	2,219,548	6,010,684
Total, 1909	3,874,200	2,007,428	5,881,628

Acid steel was 63.1 per cent. of the total in 1910, and basic 36.9 per cent. The proportion of basic steel has been slowly increasing for several years past.

Finished Steel

Partial returns show the production from bessemer steel in 1910 of 165,646 tons blooms, billets and slabs; 323,210 tons sheet bars and tinplate bars; 64,153 tons rail joints and ties; 711,915 tons rails. The total of finished forms of openhearth steel in 1910 was 4,089,668 tons; an increase of 496,308 tons over the previous year.

The production of wrought or puddled bars in Great Britain in 1910 was 876,304 long tons, a decrease of 253,108 tons from 1909. Since 1908 the returns of manufactures of finished ironwork have been arranged so as to show manufactured iron and mild steel separately. The output of mild steel in 1910 was 603,238 tons, being 125,000 tons less than in the preceding year, while the production of all finished iron amounted to 896,339 tons, as against 1,038,619 tons in 1909, and 1,050,772 tons in 1908. The figures for the three previous years, in which mild steel was not given separately, were: 1907, 1,162,058; 1906, 1,184,011; 1905, 1,116,850 tons.

Camp Bird, Ltd.

A. A. Kelsey, of London, secretary of the Camp Bird, Limited, has sent out the following announcement: "The board having received letters asking the cause of the reduction in the profits of the company for April, I am desired to say that the small return is partly due to the fact that owing to the road between the mine and the railway being blocked by snow, a larger amount of bullion and concentrates was on hand and in transit at the end of April than usual, amounting approximately to £10,000, also that the large new mill of the Santa Gertrudis company (in Mexico) has not yet come into operation as expected, but it is expected that it will begin running at the end of May, and should be at its full capacity by August, after which the engineers estimated that a profit will be made of £300,000 per annum. The directors' attention has also been drawn to statements with regard to an action started by the *aviado* shareholders of the Santa Gertrudis mine. I am instructed to say that no law suit has been brought against the Santa Gertrudis company by the *aviado* shareholders, and the company's legal advisers in Mexico have stated that the *aviado* shareholders have no legal cause for action. As a matter of fact,

the board has been approached regarding the purchase of the majority of the *aviado* shares, but the directors consider the price asked, up to the present, as excessive."

American Institute of Mining Engineers

The opening session of the spring meeting of the institute was held at the Glen Summit Springs Hotel, near Wilkes-Barre, Penn., on Tuesday evening, June 6, when the usual routine business was transacted. On Wednesday morning, June 7, the members were taken by train to Parsons, where they inspected the Mineral Springs breaker of the Lehigh Valley Coal Company. This structure, which is just completed, is of steel construction with concrete foundations, and has a special loading system, including belt and box-car loader, a new departure in breaker construction. From Parsons the party went to Wilkes-Barre, where the works of the Hazard Manufacturing Company were inspected. After lunch at the Wyoming Valley Country Club a session was held for reading of papers and discussion. A visit was also made to the Vulcan Iron Works. In the evening there was a reception at Glen Summit.

On Thursday morning June 8, visits were made to the Hauto storage plant of the Lehigh Coal and Navigation Company and the new briquetting plant of the same company at Lansford. A visit was also made to Summit Hill to examine the cutting off of the mine fire there. This fire started in 1859, in a pump house on the Mammoth bed. Various efforts were made through one-half a century to extinguish this fire and cut it off from the main workings of the colliery. The final method, which was successfully adopted, cut off the fire by a clay and concrete wall 725 ft. long, and 12 ft. thick, extending from the surface to the bottom of the coal bed. The cost of this closing off was approximately half a million dollars, in addition to over a million previously spent in unsuccessful attempts.

The party returned to Glen Summit by way of the old switchback road and Mauch Chunk. In the evening another session for reading and discussion of papers was held.

On Friday morning the members went by special train to Bethlehem, where the morning was occupied in visiting Lehigh University, special attention being given to the John Fritz engineering laboratory and the Eckley B. Coxe mining laboratory, recent additions to the University. After lunch a visit was made to the Bethlehem steel works. In the evening the final session was held at Glen Summit and the meeting adjourned. A list of the papers submitted has already been published in the JOURNAL of May 6.

On Saturday June 10, visits were made to the underground workings of various collieries by small parties of the members, each being in charge of operating officials of the various collieries.

The arrangements were in charge of the local executive committee, consisting of W. A. Lathrop, chairman; R. V. Norris, secretary; S. D. Warriner, treasurer; Irving A. Stearns, W. J. Richards, H. S. Drinker and C. D. Simpson.

Transvaal Gold Production

SPECIAL CORRESPONDENCE

Gold production in the Transvaal in May was the largest ever reported in one month, reaching a total of 685,951 oz., or 18,237 oz. more than in April. For the five months ended May 31, the total output was 3,034,324 oz. in 1910, and 3,291,585 oz.—or $68,037,062—in 1911; an increase of 257,261 oz. this year.

According to the customary monthly analysis of the production of gold on the Witwatersrand published by the Chamber of Mines, the value of the gold recovered on the Rand in March was £2,757,824 and from the outside districts £113,916, a total of £2,871,740. The gold recovered per ton milled is valued at 27s. 7d. and the total cost per ton as 17s. 11d., thus showing a working profit of 9s. 8d. per ton. The total profit of 55 companies is given as £943,415. In the month of February the recovery was nearly a shilling per ton more and the working costs four pence per ton more than in March, while the total tonnage milled during March was 1,960,678 tons against 1,712,198 in February and 1,855,232 tons in January.

LIMIT OF PROFITABLE WORKING

A somewhat sweeping assertion was made in a paper recently read here before the Chemical, Metallurgical and Mining Society to the effect that at or before a vertical depth of 5000 ft. had been reached the gold in the ore would have become so diminished that the end of profitable mining will be reached, providing the working costs remain at the present standard, that opinion being based on the figures herein given, said to be based on the published returns of the Chamber of Mines. At 1000 ft. depth the screen value per ton of ore hoisted is given at 34s.; at 2000 ft., 25s. 6d.; at 3000 ft., 21s. 3d.; at 4000 ft., 19s.; and 17s. at 5000 feet.

As a matter of fact the depth at which the ore is being worked has no bearing or effect upon its value, as may be seen in the case of the Jupiter, where the gold recovered per ton milled in March was 23s. 11d., while from a similar depth of over 4000 ft. at the Cinderella Consolidated the gold recovered per ton milled was 27s. 10d. There has long been an opinion that the value of the banket ore diminishes with depth. In some cases it undoubtedly does, while in others it has increased, a fact which shows that the banket ores vary somewhat in different areas, high value alternating with poor in any extensive area taken at random.

A rough and ready survey of the Rand shows that on the western section the value varies considerably regardless of depth. Further east occurs a lean area followed by the rich Central Rand the ore of which decreases in value at depth. Then come the poor Spes Bona, George Goch, Meyer & Charlton poor outcrops followed by the City Deep, richer in depth. Next the poverty-stricken Germiston area is followed by the improved East Rand.

What has tended in the past to give the yield an apparent falling off with the depth is that it has been governed to a large extent by the costs of working, the tendency for several years having been to mill all ore that could be treated at a profit rather than treat only the ore that would yield the highest profit.

Another remarkable estimate contained in the paper is to the effect that the cost of working may be expected to increase sixpence per ton for every additional thousand feet in depth; but the author shows in his paper that working costs have decreased from 24s. per ton in Sept. 1905, when they were working at a much less depth, to 17s. today, so that while the mines have been materially increased in depth the cost of working has been decreased to the extent of 7s. per ton. Of course, the ultimate depth to which mining can be carried on successfully depends as much on the recoverable value per ton as the working costs; both undoubtedly will be governing factors. There is a general opinion among leading mining engineers that, by working on a larger and more concentrated scale, working costs in the future, regardless of depth, will be decreased for some time to come; but what they will be ultimately reduced to, seems to be as little known as the value of the undeveloped ore on these fields, so that to speculate upon the subject at present would seem to be more or less a waste of valuable time.

Porcupine Handbook

The "Davis Handbook of the Porcupine Gold District" is a timely publication, crystallizing the geological, mining and corporate data about this interesting Ontario goldfield. The book contains besides the introductory historical and general matter a résumé of the geology by E. M. Flynn. There is a general map, together with numerous new property maps with late data as to outcrops and vein courses. A section is devoted to a review of the Cobalt district for 1910, supplementing the handbook on that district previously issued by Mr. Davis. The price of this book is $1 in paper and $1.50 in cloth, and it may be obtained through the publisher, H. P. Davis, 25 Broad street, or the McGraw-Hill Book Company, 239 West Thirty-ninth street, New York.

Traveling in Mexico

By C. S. Thomas, Jr.*

Away from the railways travel in Mexico is beset with difficulties. Many of these, however, are amusing, and the trip should be regarded merely as a strenuous holiday.

*Mining engineer, Symes building, Denver, Colo.

During the last six months I have met several young men who have been stationed at various points in Mexico. Several of them have been somewhat disgruntled over the discomforts they have had to put up with and are loud in their denunciations of the Mexican people and of the facilities which are obtainable for traveling. I have also had several talks with people who either have investments in Mexico or have been contemplating making them. The principal cause of complaint among the latter was not the lack of merit of their investments nor the distance from home that must be traversed to reach them but rather the discomforts of the trip caused by bad sleeping accommodations and troublesome facilities for traveling.

Medieval Conditions in Interior

While I could not help but agree that, once off the railroad, traveling in Mexico must be accomplished by the use of somewhat medieval appliances, such as ox carts or the hurricane deck of a mule with a gait like the pitman of a Blake crusher, yet there are compensations when one understands the people and is really interested in the country. I, for one, look upon a trip to a remote Mexican mining camp as a sort of holiday where I can get in a little rough work and shed the veneer of civilization temporarily.

The people of the remote districts are as children and, in spite of their provoking stupidity at times, they furnish a never failing source of amusement. They are faithful, as a rule, if treated properly and in accordance with their temperaments and I, for one, have never had any trouble with them. It is true that their ideas of the Ten Commandments are different from ours, but this fact only need make one careful of his baggage and it generally affords some amusement. One cannot leave an automobile standing in the streets without a guardian; otherwise it will be well to have no brass accessories or other removables on it.

Last summer I had occasion to make two extended trips in Mexico, one into the wilds of Guerrero and the other into the old district of Guanacevi, in Durango. The former took in the Reforma mine at Campo Morado, one of the largest ore deposits it has ever been my good fortune to see and inspect. On this trip there was a good-sized party of us, five Americans, to whom I will refer as Fred, John, Billy, Fritz and myself.

We left Mexico City early one morning in June, taking the train for Cuernavaca and Balsas. Nothing of note happened on this rather monotonous all-day trip and we arrived at Balsas about 5:30 in the afternoon. Balsas is a town that really has as its reason for existence the fact that it is the railway terminus. There are about 500 inhabitants there, if one does not count the pigs. Otherwise the population would be some thousands. The pig is the national scavenger in Mexico and deserves mention in the census figures. The town is built in a straggling fashion in a little flat at the junction of a minor stream with the Balsas river. It is a beautiful situation, placed as it is by the side of the river, a broad, deep stream running swiftly through a narrow, rugged and deep gorge. The town itself, of course, is not beautiful except from sufficient distance to render the olfactory nerves immune.

Sojourning at Balsas

There is no hotel at Balsas. There are one or two places where a bed might be shared with a few thousand of sundry varieties of insects, but we preferred other company if it was possible to secure it. Sleeping out of doors was open to the objection that the pigs are unpleasantly inquisitive and always hungry, and to sleep without one eye open all the time and a club in the hand was out of the question. The local manager of the Reforma Mining Company's storehouse solved the problem by setting cots for us in the coke shed. Iced tea and a good supper were obtainable at a Chinese eating house for the price of "six bits, Mex."

Supper over, we enjoyed our cigars, the beautiful, hot evening, and the Southern Cross just showing above the hills to the south. Our "hotel," being constructed of corrugated iron, was comparable, without exaggeration, to an oven and we were not keen about going to bed any sooner than necessary. So Fred regaled the party with wild tales of the vagaries and customs of "José," as he termed the entire pig family, individually and collectively. We finally had to go to bed in self defense. John was careful, however, to rig a pig-proof barrier at the door.

We were up before the sun and ready for our all-day trip down the Balsas river. The day before, the crew of one of the four-ton barges that operate on the river had arranged their boat with a canvas awning and we supplemented this luxury with a five-gallon can of iced tea obtained from the Chinaman, and set out. The barges are rough affairs constructed from native wood. They are about 25 ft. long, seven wide and three deep. They are pointed at one end and are flat bottomed. They are operated by four-peon power applied to a pair of clumsy sweeps placed at the bow. Supplies, such as coke for the smeltery and the various things needed for mining, are freighted down the river in them, the swift current carrying them to Pezoapan, the river station of the Reforma mine, in about eight hours, a distance of 84 km. On the return trip, the crew has to tow the barge upstream, an arduous job requiring three days.

Shooting Balsas Rapids

In the 84 km. there are about 74 rapids to pass. The boatmen, just before reaching a rapid, generally swing the boat with the stern down stream, then, upon reaching the curve of the rapid, the boat is swung around again and shoots bow first into the quieter water below. If the rapid is a straight one they take it bow on the entire distance. The first few rapids are likely to cause the uninitiated passenger to have a prickly sensation at the hair roots; but after the novelty has worn off, one is likely to become most nonchalant, or even bored, notwithstanding the fact that an occasional wave may cause his frail craft to ship a barrel or so of water. Alligators abound and we had several good shots. The cry of *"Caïman!"* from the boatman always caused a scramble for the rifle. There was no way of securing the reptiles, once shot, without great loss of time, so we were obliged to refrain from securing trophies.

At Pezoapan we disembarked at about 4:30 in the afternoon and took to horseback for the remaining 30 km. There was about a gallon of lukewarm tea left and Fred gave it to the natives. They drank it with avidity and then waited around expectantly for results. When informed that it was tea, not "booze," they were much disappointed. We arrived at the mine at about 9:30 after a hard ride over rough trails. The country from Balsas to Campo Morado is rugged, cut by deep cañons the precipitous walls of which form high mountains. The prevailing rocks are limestones, shales, slates, etc., locally much folded and faulted. All the way down the Balsas river the various beds of these rocks appeared dipping steeply up or down stream and forming a deep, rugged gorge. Occasional intrusive bodies appeared as sills between the beds. From Pezoapan to Campo Morado the same beds of shale

and slate were crossed by a large dike of a coarse-grained porphyry.

At the Reforma mine a body of granodiorite has intruded itself into the slates and forms the hanging wall of a great lode, opened by six levels in the mine, and showing a length of 2500 ft., an average width of 100 ft., and a depth opened of about 750 ft. It is all a solid pyrite body, passing entirely through the mountain like a layer of chocolate in a cake, oxidized, and somewhat shattered near the surface on account of the diminution of volume caused by oxidation. This pyrite partially replaces slates in a great shattered fissure and partially merely cements the shattered fragments. The body for its entire width averages about 1.7 per cent. copper, 0.11 oz. gold and 3.5 oz. silver per ton. Everyone was extremely comfortable at the mine with the exception of myself. A noteworthy fact was the absence of "José's." We had good, airy, comfortable quarters, but good fortune deserted me and I drew a cot with a great many *chinches* already in possession. Several times during that first night I made a painstaking campaign all over the bed, but somehow or other there was always a reserve supply ready when the light went out. Finally, acknowledging the *chinche* victorious, I took to the floor and secured some rest. A few bold ones followed me there but not enough to make much disturbance. I had a general cleanup of the whole place and thereafter slept in peace.

Return to Balsas

Our stay at the mine was pleasant and we were shown every courtesy by the owners. We were permitted to view everything about the property and our continual broadsides of questions were answered painstakingly and in detail. When the time came for departure we left with many regrets. The trip back to Balsas was made on horseback over a characteristic Mexican trail that picks out the deepest places in the cañons and the highest points of the mountains. We did go over one pass at Limonticlan where the trail could have gone a few hundred feet higher. This was probably an oversight on the part of the builders. I called attention to it and it will doubtless be corrected in time. The trail winds over much the same sort of country as we passed through on the river trip. It is all rugged and, as in the cañon, is composed of sedimentaries somewhat folded and faulted. Small areas of porphyry were passed, generally well down in the cañons.

The return trip this way requires about two days. The villages in Guerrero are small and scattered wide apart, so that the choice of places to spend the night is restricted. About five o'clock we arrived at a characteristically filthy village called Apaxtla. We were led by our *mozo* to a general store, *cantina* and home which formed one side of a corral. We entered the corral and unsaddled our animals. After a ride lasting from dawn until five, the entire party was tired, particularly John and Billy, who were "all in," the latter having been assisted to that state by a bottle of warm beer. Fritz found a couch and proceeded to rest his weary bones, so it was up to Fred and me to make preparations in the corral to spend the night.

No Pigs Wanted as Bedfellows

As usual, the corral was full of "Josés," burros and a few horses. Sleep was therefore out of the question unless we could get rid of the livestock. Horses aren't bad to sleep with, but pigs and burros—never. We drove all of the tribe of José out of the corral first. This had to be done twice, for the door through the store and house parlor was open, and they all came back that way after the first exodus. Fred had heard, some place, that if a burro's tail were weighted he couldn't bray. Never having had occasion before to try it, we put it to the test. It is a fact that the burro did not bray within hearing distance under these circumstances, but that is as far as our proof went, for the entire herd headed for the open country. It cost us in the neighborhood of a peso to salve the outraged feelings of several owners of livestock, and as a payment for the privilege of allowing them to sleep outside the corral. The peso, incidentally, cost us about a half hour of haggling and gesticulation. Fred then ingratiated himself with the duenna of the place by a little "soft soap" and a cigarette, and we had chicken for dinner and breakfast, together with the ever present *frijoles* and *tortillas*.

The next morning saw us off at daybreak and one o'clock saw us at Balsas. Balsas looked pretty good to us on our return and it didn't take us long to clean the Chinaman out of food and iced tea. In the afternoon Fred, John and I undertook to take a bath in the creek. It was evidently wash day in Balsas, for we were no sooner immersed in a rather nice pool than several native women came down and proceeded to wash clothes with a nonchalance that seemed to indicate that our presence in the pool was neither a benefit nor a detriment. Even Fred's Spanish wasn't equal to the occasion. One more night in the coke shed and we were off for Mexico City, reaching there unscathed in the evening in time to lose a few "dobes" betting on the *quiñelas* at the jai-a-lai game.

From Mexico City to Guanacevi

A day or so later I left Mexico City for Torreon, thence to go to Guanacevi. My companions on this trip were one American and a Mexican engineer, both agreeable companions. We left Torreon one morning and arrived at Durango at about six in the evening. Change of train must be made here for the mixed train to Tepehuanes, leaving every other day. This gave me an opportunity while there to see the Cerro Mercado, a veritable mountain of iron ore, said to contain about four hundred million tons of ore that will assay over 65 per cent. iron, and the old furnaces built many years ago in an effort to produce pig iron. The next morning we left Durango behind and proceeded on our bumpy, laborious journey to Tepehuanes. The trip was considerably enlivened by the bishop of Durango, who boarded the train at Santiago Papasquiero. From there to Tepehuanes the trip was much in the way of a triumphal procession. At each station the entire population, including the dogs, burros and pigs, turned out, the former to fight for the ecclesiastical smile and blessing and the latter on the lookout for any stray scraps of refuse.

At Tepehuanes a garland-decorated buggy, drawn by a bunch of Mexicanos, awaited the bishop. Along the streets of the town, across the river from the railroad station, were young girls dressed in white and provided with flowers to strew on the pathway when the procession should begin. There were floral arches galore and the entire town had the appearance of having been neglected for so long by the bishop that its sins had become so abnormal as to require preparations even out of the ordinary. We made the *faux pas* of fording the river ahead of the procession. Perhaps it was this indignity and perhaps not that made the human draft animals careless or excited, for they almost spilled the bishop's benevolent frame into the "drink." It was a rather undignified position for his grace during one moment, and his efforts to defeat gravity, finally successful, would have been ludicrous in any other country but Mexico. It wasn't laughable for us *gringoes*, however, until we were at the hotel, safe from any stray brickbats. One sanctified rascal tried to steal my grip in the very presence of the bishop, probably reasoning that I was a *gringo* anyway, and if he could get away with it before confession it would be all right.

An Underpowered Coach

We left Tepehuanes while yet dark, the next morning. Our equipage was an old stage coach weighing several thousand pounds, drawn by six underfed, undersized mules, and manned by two *peones*—one, the driver, who devoted his entire attention to beating the two wheelers; the other, a *mozo*, on foot, who devoted his time to belaboring the four leaders and dwelling at length on their ancestors throughout several generations. The rainy season was on; the road, if such it may be called, was heavy and the grade steep. The mules, pulled each his own sweet way, generally in every direc-

tion but the right one. We spent the greater part of our time in carrying the coach and six mules up the steeper pitches. Señor Cepeda, the Mexican engineer, had wired ahead for a good team and wagon. This was it. Speculations as to what we would have gotten but for this foresight were most discouraging. It began to look as if we wouldn't make El Zape in time to spend the night there, but we finally arrived and secured a good supper.

El Zape lies at the junction of two streams. It is the scene of considerable thermal activity. There are several thermal springs there and one can take a bath, if desired. They are mostly used for softening corn prior to the preparation of tortillas. The waters have a temperature of about 120 deg. F., and resemble, in odor at least, those of Steamboat springs, in Nevada. I sought for the meaning of *zape* in vain. I had conjured up the idea that it might have something to do with the hot springs. the best clue I could get was that *zape* was the equivalent of "skidoo" or "scat," as it expressed the desire for sudden evacuation of a space occupied by a cat. Asked where the cat was, they looked at me in pity and changed the subject. The next day I insisted on a lighter conveyance, and got it—after an argument. This was so much better that our *mozo,* the second "whip," had to ride a horse. This was unfortunate, for we lost considerable time every time we had to pass through a gate. He invariably opened it for us and, shutting it, would mount his horse only to find he had shut himself out. He performed this Marceline prank so often that, had we not reached Guanacevi soon, it would have become monotonous.

Guanacevi

Guanacevi is one of the oldest mining camps in Mexico. The Spaniards in the Sixteenth century invaded its precincts and found active mining in progress. How long before that the mines were first opened is not known. It is a district of immense veins and great outcrops forming recurring series of great buttes. The ores near the surface were rich and easily reduced. With depth they became poorer and more rebellious and most of the properties closed down. One or two of them are working and milling their ores, but the extraction obtained and the high costs are far from satisfactory. A few companies hand sort a few miserable tons per day and send it to Torreon as a present to the smeltery. I say present advisedly, for freight and treatment are $60 per ton, moisture is always high, even if the cars stand for a month in the arid, torrid yards at Torreon, and as little as possible is paid for silver and gold. We had an extra passenger on the return trip, a Señor Iturbe, one of the owners of the mine I had come to examine. We left Guanacevi in a driving rain. The road was heavy and the mules reluctant. Our *mozo,* however, livened things up a bit by scaring up a few dejected coyotes for us to practice pistol markmanship upon. The coyotes were safe, even though lacking in the ambition to remove themselves from the state.

Leaving the Ball before the Battle

At Zape we found a wedding had just been celebrated and the inevitable *baile* was on. Invited by our bibulous landlord to attend, we drank a couple to the bride, compared her gawky figure and dusky, featureless face to the swan (fingers crossed) and left before it should become time for the climax of mescal jags and the production of knives. We left Zape before daybreak, with the fiddle still squeaking and the ball in full swing —no fatalities up to our departure.

Our mules were "all in" when, at noon, we reached Cienegas, a collection of a half-dozen mud huts, a dozen people, 30 or 40 children and as many pigs. The mud was up to the hubs and it looked as though there would be no Tepehuanes for us that night. We decided to cut loose and ride the rest of the way. Cepeda and Iturbe decided to trust to the wagon, so my American companion and I each took a mule and departed over the worst trail it has ever been my misfortune to travel. Our *mozo* was disposed to take the trip peacefully and in slumber and at a speed of about two kilometers an hour. The mules exhibited the same inclinations. Not so, we. Leaving the *mozo* to follow, we cut clubs and exercised unremittingly with them until Tepehuanes and a real railroad track showed up before us, just at dusk. Cepeda and Iturbe turned up about 2 a.m., just in time to join us at breakfast and go to the train. We made Torreon as fast as the railroad schedule would let us and in spite of the fact that some midnight marauders stole the bell from the switch engine in the yard at Torreon while the crew was absent. I left for the States by the next train.

The trip outlined above sounds awful, but I found a great deal of humor in it. On my return I was able to eat as never before (a possible argument against the trip, now that we hear so much about the high cost of living), and I could even negotiate the San Juan mountains of Colorado without shortness of breath. I maintain that trips into the interior of Mexico are instructive, interesting, humorous, beneficial and in the nature of a holiday, provided one is in good health and in good company.

An unmagnetizable steel alloy is said (U. S. Pat. 981,575) to contain Mn, 9.8 to 10.3 per cent.; C, 0.9 to 1.0; Ti, 0.2 to 1.4. The silicon must not exceed 0.8 per cent.; C, 0.03; and P, 0.015 per cent.

Lucky Tiger Combination

The Lucky Tiger-Combination Gold Mining Company, of Kansas City, operating in Sonora, has issued a report to stockholders as follows: "The company's operations at the mines have been uninterrupted since the last month's statement, but owing to the disturbed political conditions and the fact that the field of operations of the revolutionary forces of Mexico was, to a large extent, in northern Sonora and Chihuahua, traffic on the Nacozari railroad suspended, and the port of Agua Prieta, through which all of the ores of the company are exported, was closed, so that only three carloads of ore were shipped to El Paso. During the last few days the port of Agua Prieta has been reopened. New officials have been designated, awaiting approval of the interim government, and a temporary war tax of 1 per cent. imposed.

"The production of ore at the mine, however, has been fully equal to that of previous months of the year, the total production of shipping ore being about 175 tons, while the mill has produced the usual quantity of concentrates. There have been some important orebodies developed in the Sooy vein on the seventh level, while some pockets have produced ore extraordinarily rich in gold and silver. The estimated profit for the last month is $38,000, which is in excess of the regular monthly dividend heretofore paid by the company. The manager reports that the cyanide mill has been entirely completed and is ready for operation. The transmission line was completed and connected up and electric current sent over it June 3. The power line and the new mills will be put in operation during June, so that the production at the mine will be greatly increased. Notwithstanding these favorable conditions, the directors believe that it would not be wise to resume the payment of dividends the current month, in view of the unsettled political conditions in Mexico and the uncertainty as to the resumption of ore shipments."

Paramatta and Yelta Mines

The South Australian government has purchased the Paramatta and Yelta mines, near Moonta, for £6000. These mines were worked by a French company from 1903 to the copper slump in 1907, producing about £250,000 worth of copper. The Yelta has a smeltery, connected by a tramway with the Paramatta. The area bought is 1349 acres which, with the exception of the land required for actual operations, will be cut up into farms of 20 to 30 acres. The government geologist, commenting on the purchase in his report, remarks that it is believed this is a good bargain for the government.

Filling Methods at Sudbury

By W. R. Crane *

At the Ontario nickel mines haulage drifts are dry-walled; ore is won by breast and longwall stoping while the walls are temporarily supported by waste or ore; waste filling is drawn from exhausted stopes to the stopes that are being worked below.

*Penn State College, State College, Penn.

The extension of the filling system of mining to the mines of the Sudbury, Ont., nickel region has led to some interesting modifications of the so called dry- or rock-wall system as employed in a number of the large mines of the Lake Superior copper region of the United States. Brief descriptions and a discussion of the methods employed in the several mines of the districts mentioned may be of interest to ore miners.

The Trimountain Method

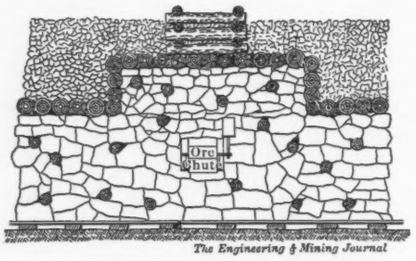
In the Trimountain method stations are formed at intervals of about 125 ft. along the line of the shaft, which is usually sunk in the lode. From the stations levels are driven both to the right and left 8 ft. high and the width of the lode wide, and at proper grade along the line of the lode. The level drifts are enlarged by stoping and from the rock broken down, the larger pieces of waste are employed in building dry walls which are 8 ft. high. On the walls timbers are placed, which extend from one wall to the other, upon which in turn is laid a lagging of poles and slabs. The timbers covering the space inclosed by the walls are called "wall pieces" and vary in size from 18 to 24 in., being 14 ft. long. As the work of stoping proceeds, the waste rock sorted from the ore is stored between the dry walls and the foot- and hanging-walls until these spaces are full and is then thrown upon the lagging, thus covering the walled passage.

Mill holes are formed in the walls on the foot-wall side of the passages and are built up as the stopes increase in hight. The mill holes are round, 5 ft. in diameter, and when completed are about 50 ft. deep.

Owing to the high pitch of the lode, also the width, it is necessary to mount the drills employed in stoping between the working face and the broken ore and rock below. Pickers and trammers work at the rear of the bank of broken rock, sorting out the pay ore and storing the waste in the stope, thus leveling the bank of broken ground which is constantly being added to by the advance of the drilling operations. From 25 to 45 per cent. of the lode rock is waste and is available for filling; however, if there is not a sufficient amount to fill the stopes, the foot-wall may be broken down to furnish more. Cutting out is continued up to within about 20 ft. of the level above, where it is stopped, thus leaving an arch pillar, which is broken at more or less regular intervals by openings or "breakthroughs."

Same Filling Used in Several Stopes

As the work of extracting the ore proceeds from above downward, the upper stopes are first exhausted and abandoned, thus removing the necessity of support and protection for the levels at those points. The filling can then be drawn off into the next lower stope or stopes, where it serves a useful purpose in assisting in stoping out the arch pillars by providing a support for the miners in drilling. The filling is drawn off by making openings in the dry walls of the filled stopes at points directly over breakthroughs in the arch pillars of the stopes to be filled. The stopes are then allowed to fill as full as the size of the breakthroughs will permit. Drills are then mounted under the ends of the pillars, adjacent to and on the inclined surface of the fills. A portion of the pillars about 10 ft. in width and from 15 to 20 ft. in length is then removed as in stoping. The drills are then reversed and holes are drilled which, when charged and fired, will break down the ends of the pillars, thus enlarging the openings through which the filling flows. By these two successive operations the arch pillars are gradually removed, footing for the miners being provided by the movement of the filling from above downward, thus maintaining the same relative position with respect to the pillars. The rock as broken from the pillars falls upon the surface of the filling and is carried to the pickers or sorters below by its downward and lateral movement. A number of break-throughs may be opened in a similar manner in the same stope, thus permitting rapid removal of the arch pillars and the filling of the stopes. Picking out of pay ore and spreading of waste are carried on as in the cutting-out stoping operations.



Dry Wall Passage at Station

The method of mining employed in the Trimountain mine is in reality a combination of methods, being longwall and rill stoping, a filling method and the dry-wall level-forming method.

The Crean Hill Method

While the method employed in the Crean Hill mine in the Sudbury nickel region is in principle the same as that used in the Trimountain mine, yet owing to the difference in occurrence of the ore, the method of procedure is quite different. Systematic and extensive prospect drilling at the Crean Hill mine revealed the fact that what were formerly supposed to be isolated bodies of nickel ore were in reality connected, the irregularities being due to the occurrence of inclosed masses of rock which are not usually extensively mixed with the ore. How to dispose of the inclosed barren material in an economical manner was the problem that confronted the management of the property, and was finally solved by the employment of the dry-wall filling system.

Drifts are driven from the shaft, forming levels 125 ft. apart and are extended into the orebody, following the direction of the major axis as nearly as possible, and as straight as conditions will permit. The initial or exploratory drifts are carried from 8 to 9 ft. in hight, later being widened out and raised to a hight of 30 ft. A stope is thus formed ranging in hight from 30 to 35 ft. and in width about the same, although widths of 50 to 60 ft. are common. The various drifts on a level are raised and widened out by the stoping operations until the stopes so formed break through the intervening strips of ground and form continuous stopes, but for the portions of ground left standing as supporting pillars. The pillars vary in size, depending upon the character of the ground; ordinarily they are 25 ft. across, but with lean ground they may be made larger. All ore pillars are ultimately removed, while those composed of barren rock are left to collapse and mingle with the filling.

In opening up a level the waste and ore are both sent to the surface until the level drift has been driven to the boundary of the workable orebody, after which the waste is left in the stopes and built into dry walls for the protection of the levels. While the dry walls are being built in the completed drifts, driven in one direction, work is begun on the drifts to be opened up in the opposite or a different direction. The second part

of the development work on a level may furnish a limited amount of material for dry-wall building in the completed portion. The building of the dry walls and the filling in around them with waste constitutes the first step in filling and should be sufficient to provide support for the drills in removing the first slice from the back of the drifts.

Breast Stoping used to Extend the Stopes

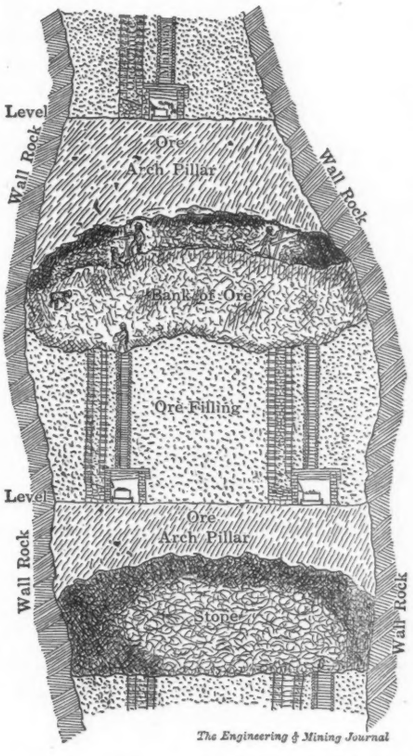
The stopes are carried to the limit of the workable ground by a system of breast or side stoping, which consists in making a cut across the stope about nine feet deep and high and by successive overhand cuts raising it to the top of the 30-ft. stope, thus advancing the face of the stope by the depth of the cut. The next subsequent stage of advance is made by making a cut into the face, level with the top of the stope and then by underhand work removing the ore to the floor level.

The ore is then removed by alternate up and down work on the face, which is maintained as nearly vertical as possible. The drills are mounted on waste filling during upward working and on unmined ground when working downward. When a stope has been raised to the standard hight of 30 ft. and the ore and waste properly disposed of, the main work of extracting the ore is begun. The waste obtained in cutting out the 30 ft. stopes is left in the stopes but is seldom sufficient to fill them to the desired hight, thus requiring the introduction of filling from other sources, but always from a higher level.

During the side-stoping operations as much ore is extracted as possible, the poorer portions being left standing in pillars, thus a considerable portion of the inclosed masses of low-grade ore, or rock is utilized as temporary support in the stopes. It is thus possible to obviate the breaking and handling of a large part of the barren ground, an important consideration from the standpoint of economy. The dry-walls are built seven feet high and about four feet thick. Into the walls are built ore chutes and manways; the former are round in section and solid, up to the bottom of the loading chute, above which point they are dry stone walls bound together by 8 to 11 in. round timber. The bottom of the ore chutes are lined with sheet metal or cast-iron plate. The manways are rectangular in section, being 4½ by 5½ ft. inside, and are constructed in a manner similar to the ore chutes, having a bond of round timbers. The manways are just large enough to permit a tram car to be hoisted to the open stope above, where they are employed in handling ore and waste. In the manways are ladders and wrought-iron pipes for drill-steel chutes, which are 4 in. in diameter.

Manways and Dry-walls

It is evident from the above that the ore chutes and manways stand to one side of the dry-wall passages and are, therefore, more permanent than if built over the passages. The manways differ from the ore chutes in that they are open from the level-floor, an opening or niche being formed in the dry-wall. This opening is protected by posts and caps 14x14 in. in size, above which it is dry-walled on all four sides. The hight of the level drifts, where ore chutes and manways occur, is usually 12 ft. to provide room for handling cars, timber, etc., which is fully four feet higher than the usual hight of the dry-wall passages. Ore is discharged from the ore chutes by air-



Section through Orebody and Stopes

operated iron gates, thus facilitating its handling.

The dry-walls are spaced about eight feet apart for single tracks and 12 to 13 ft. for double track. Extending from wall to wall are rough round timbers, ranging from 10 to 14 in. in diameter, upon which are placed pine-pole lagging to insure against the falling of pieces of filling. On the completion of the dry-walls the remaining waste is stowed between them and the walls of unmined ore and rock. The waste rock from the preliminary stoping operations together with other refuse materials brought in from the surface or stopes above, are stowed in the stopes until only eight to 10 ft. of space is left between the top of the filling and the back of the stopes. The first stope (30 ft. high) having been formed and filled with waste, the work of removing the remainder of the ore standing between levels is begun, which is accomplished by longwall stoping, i.e., cutting or breaking down the back in horizontal slices, support for the drills being obtained by mounting them first upon the waste filling and later upon the piles of ore broken down.

Sorting Waste

In order that the waste material sorted from the ore broken down in the longwall stoping operations can be handled to the best advantage, the stopes are developed and worked in a stepped or terraced formation. The successive stoping operations, extending from the lowest to the highest, form banks of waste, which being added to from above flow downward, thus maintaining the same relative position between filling and stope backs. The highest terrace having been completed, work is continued on the next lower, etc., until finally the filling and stope backs form practically continuous horizontal lines through the stopes. This method of placing the waste as filling resembles rill-stoping now extensively employed in many mines both in the United States and abroad.

There is never enough waste obtained by sorting the broken ground in this mine to fill the stopes to the desired hight and consequently a certain amount of rock must be brought in through raises connected with the levels above. Permanent foot-wall raises or chutes are made for handling the filling, and are regularly maintained throughout the mine for that purpose. As it is somewhat difficult to arrange such chutes so as to serve all parts conveniently, it is usual practice to put in small raises where especially needed to tap the filling above and place it to the best advantage. In this system seldom more than three levels are worked at one time, which maintain the following relation to one another: the uppermost is completing the stoping operations or removing the arch pillar; the lowermost or bottom one is being opened up, while the intermediate level is back- or longwall-stoping. By such an arrangement of workings the protection of the various levels is readily accomplished, caving and squeezes being readily controlled.

Removal of the Pillars

The removal of the arch pillars is accomplished by taking slices from the lower sides until the stopes break through into the levels above, which should occur at points as far distant from the shaft as possible. While considerable ore is lost during the drawing of the arch pillars, yet much is saved being transferred below through the ore chutes. When the arch pillars are wholly removed, the dry-walled passages collapse and slide down into the stope below together with the fill of the stope above.

The removal of the stope pillars, i.e., those situated at various points on the level-floor is accomplished in a manner similar to that employed in drawing the arch pillars, being undercut from below. They may break up and settle down gradually, their movement being controlled largely by the inclosing filling. An upper level having been once filled there is little need of providing for other sources of filling, as that from the upper stopes can be drawn upon and is thus used over and over again.

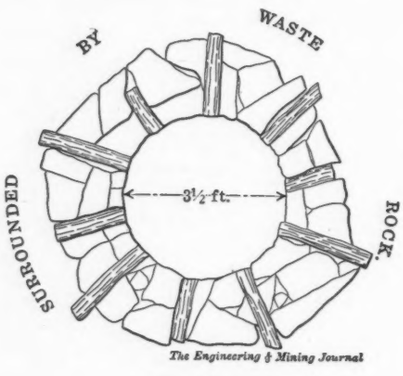
The Creighton Method

In the Creighton mine the levels are spaced about 100 ft. apart vertically, stopes being opened up to the full width of the orebody and are increased in hight by overhand stoping along the lines of the level drifts. When sufficient room has been made in a drift by clearing away the ore and waste, the latter being sorted and left in the stopes as far as possible, the construction of the dry-walls is begun. The walls are built of the large pieces of waste rock remaining in the stopes, are three to four feet thick and six feet high. At the points where ore chutes and manways occur the hight is made 10 ft., being increased abruptly four feet as shown in an accompanying illustration; the length of the enlarged portion of the drift or station is 12 ft., thus providing sufficient room for handling supplies and loading cars. The ore chutes are round, 3½ ft. in diameter and are built of waste rock and occasionally three-foot lengths of 8- to 10-in. logs are placed radially to bind the walls together securely and prevent deformation. Air-operated ore gates are also employed to draw off ore from the chutes.

The manways are rectangular and are large enough to permit tram cars to be raised and lowered through them. They are lined or cribbed with round logs and are built directly over the dry-walled passages rather than to one side as is the practice in the Crean Hill mine, and as the ore chutes are placed. The manways are are provided with ladders and pipes for steel chutes, and aside from forming convenient means of ingress and egress to and from the stopes, permit the running of air lines from the mains to the drills in the stopes above. In wide orebodies it is customary to provide two haulage ways on each level-floor, thus reducing the amount of handling that would otherwise be necessary if only one passage was formed. Stopes opened in the large masses of pyrrhotite found in this mine produce little or no waste material which could be utilized as filling, and it is, therefore, the practice here to employ the broken ore as filling. The stopes are raised to a hight of about 60 ft. without having the ore drawn off except as it is found necessary to provide working space at the face, or between the back of the stope and the broken ore. It is then evident that the method employed in this mine is shrinkage stoping and provides a large reserve of ore which can be drawn upon in case of emergency.

Size of Arch Pillars

Owing to the strength of the rock and ore, in both the Crean Hill and Creighton mines, it is found possible, with little or no risk of collapse, to carry stopes 100 ft. high and with widths of 60 to 80 ft. Care must, however, be taken in forming the back of the stopes into rough arches, suited to the character and strength of the rock and ore, in order that the dome of equilibrium may be maintained. It is the intention ultimately to mine all of the ore in the orebodies of the Creighton mine, but at present no attempt is made to carry the stopes much above 60 to 70 ft., thus leaving an arch pillar of 30 to 40 ft. in thickness. Practically all of the mines in the Sudbury region are worked more or less by opencuts, which provides a convenient method of mining during the summer months, the underground operations while worked practically the entire year are intended particularly for winter work. Stoping in the Creighton mine is back or overhand stoping and while it resembles longwall work it is hardly conducted systematically enough to warrant that designation. The use of ore as temporary filling precludes the use of waste and for that reason the arch pillars must be left standing, at least until the ore filling has been drawn off, after which they may be attacked, but not without danger of starting serious caves and squeezes in the mine.



Ore Chute

The dry-wall methods of mining, as applied to the three mines mentioned, are in reality filling methods; the two first mentioned, namely, the Trimountain and Crean Hill mines, employ waste rock as filling, while the Creighton uses ore. Further, while the use of filling is similar in each, i.e., is temporary, yet owing to the difference in character of the filling materials used the method employed in the Creighton mine is of necessity quite different from the Trimountain and Crean Hill mines.

In the Creighton mine the stopes must be self-supporting even when carried to the full hight, for they must remain open until their content of broken ore has been discharged. Should they collapse before the ore has been fully withdrawn, considerable ore would be lost or materially reduced in value by being mixed with waste. The method of securing and placing the filling in the Trimountain and Crean Hill mines resembles the method of mining commonly known as back filling, and as the sloping bank of filling is employed, in certain parts of the stoping operations, as a footing for the drills, the method may be designated as rill stoping. In the case of the Creighton mine, where ore is broken down and stored in the stopes, being drawn off sufficiently during stoping to provide room for the mounting of drills between the back and the filling, we have the so called shrinkage-stoping method.

Comparison of Methods

In comparing these methods with those employed in other mines, the following points may be noted to advantage: (1) Ore can be readily sorted in the large stopes and the waste stowed with a minimum amount of work. A fairly clean product is sent to the surface. (2) The sorted waste rock is employed as support in the mines which, together with a certain amount introduced into the stopes from the surface, reduces the timber support to a minimum. The cost of handling the filling in the Trimountain and Crean Hill mines is materially reduced by employing gravity in its distribution. (3) The Trimountain and Crean Hill mines operate to special advantage in that the filling is used over and over again, which in spite of certain minor disadvantages had a decided advantage from the standpoint of economy. (4) A high extraction of ore is possible in the Trimountain and Crean Hill mines, owing to the drawing of the pillars, while the reverse is true in the Creighton mine. The character and amount of ore available is, however, probably largely responsible for this. (5) The cost of handling ore in the Creighton stopes is slight, owing to the efficient methods employed and convenience of ore chutes to working face. (6) While the ore filling in the Creighton stopes gives temporary support only, yet the advantage of having a reserve of ore largely offsets other minor disadvantages. (7) Little timber is required for support, being employed mainly as partial support for haulageways and in the lining of manways. (8) The methods employed in all of these mines are remarkably safe, as has been demonstrated by years of use. (9) The stopes are always easy of access, which also insures good ventilation. (10) While the cost of the dry-wall building is rather high, yet its great strength and permanency and small maintenance cost render

it fully as cheap as any other form of support for haulage ways. (11) As stoping is done on a free face and with the assistance of gravity, a large quantity of explosive is saved and consequent cost per ton of ore broken is comparatively slight. (12) There is considerable loss of ore through mixing with waste, which is particularly true where ore is broken on waste filling. (13) There is, of course, always danger of a crush starting in the upper levels and extending throughout the workings.

Owing to the exceptional strength of the ore and rock in which the stopes are opened, particularly in the mines of the Sudbury nickel region, it is possible to employ the dry-wall method with special modifications in a way that could not safely be done in other mines less favorably constituted. The advantages and disadvantages given above are, therefore, more relative than general, and should not be otherwise construed.

West African Mining

LONDON CORRESPONDENCE

It was during the latter part of 1900 and the early part of 1901 that the boom in the West African mining districts near Tarkwa, Prestea and Broomassie began in earnest, although the Ashanti goldfields had been worked for many years, but as that district is 100 miles farther in the interior it did not participate in the boom. The Taquah mine, which had been worked for many years before 1900 was then idle, probably on account of the heavy freight charges from the port of Sekondi, as all the machinery and supplies had to be carried by the Fanti or Kroo boys for fully 40 miles.

Tarkwa and the other districts were hard to prospect, in spite of the facilities afforded by the railway company in carrying passengers at certain times for a distance of 30 miles or as far as rails were laid. Ten years ago the mining engineer had a difficult and sometimes a dangerous search through dense jungles for shafts which did not exist and for lodes which were never exposed, but which the promoters could lay down on a plan without a break, interruption or fault and usually in such a way that the lodes should traverse the greatest distance of the square block or claim.

DIFFICULTIES OF THE FORMER YEARS

To prospect, or examine properties in such a damp, foggy, fever-infested district abounding with millions of malaria-breeding mosquitoes and miles of black ants marching in line through larder boxes; a country without roads and sometimes without trails and without bridges to cross the rivers or streams; without any food save that carried by Kroo, Fanti or other natives; without water for domestic purposes unless boiled and filtered (one contractor insisted in the contract that all his European workmen should have a standard brand of mineral water to drink and which was imported from England; without a store "where lies are swapped" and without a roulette wheel or a faro table, is an experience not easily forgotten.

Occasionally when passing through a native village all the eggs, Tom Thumb like in size, were purchased and sometimes if one were very hungry a hunt would be undertaken to capture a fowl that combined not only a unparalleled swiftness of foot and wing, but the cunning of a fox.

All this has been changed and the mines now own their domestic supplies of waters for the native as well as the European workmen; there are good roads and even branch railway lines; the marshes have been drained; a cold-storage warehouse for furnishing to the different mining camps a good and plentiful supply of fresh foods and produce of every kind; in short, nothing has been neglected to make the mining camps, if not sanatariums fairly healthy. It is also pleasing to note that the death rate in the mines through accidents is kept at about two per thousand.

THE FANTI MINES

The Fanti Mines are capitalized for £500,000 in 2,000,000 shares of 5s. par each. The mine has not reached the producing stage, although the reserves are estimated at 93,000 tons, assaying 6.17 dwt., and 185,000 tons at 3.7 dwt. The vein in the lower levels, the sixth and seventh, is in much less disturbed country than in the upper levels, consequently the developments should be more rapid. The vertical part of the shaft has been abandoned and the incline continued to surface.

The Fanti Consolidated company, exclusive of options, owns an area of 87 square miles, but not in one block. The capital of the company is £600,000 in shares of 10s. each, nearly half of which are held by the "great ones in the city," such as, United Exploration, Eckstein & Rube, Otto Beit, Rube & Wagner, Gold Coast Amalgamated, etc. On Dec. 31, 1910, the company had cash resources of $179,000.

THE WASSAW MINES

The Effuenta company has had rather an unsuccessful year, the capital is nearly exhausted and the mine will probably be closed until such time as the low-grade ore can be profitably treated, and to await the further development of adjoining mines. The developments have not borne out the results from the assays taken from the cores of the diamond-drill holes. During the year the shaft was sunk 477 ft., making a total depth of 1142 ft. on the incline. The assays in the different levels are all low, while the bore holes which were drilled some years ago gave values as high as 24 dwt. The Fanti Consolidated owns 125,000 and the Gold Coast Amalgamated 110,000 shares.

Wassaw West Amalgamated mines have to be careful of their remaining capital, as the developments have not exposed any rich ore. The estimates are said to be 50,000 tons of 5.4-dwt. and 186,000 tons of 3.2-dwt. ore. The costs will have to be materially reduced before this 186,000 tons can be profitably treated.

ABBONTIAKOON

The capital of Abbontiakoon Mines, Ltd., has been increased to £800,000. The Fanti Consolidated and the Gold Coast Amalgamated own 180,000 and 147,000 shares, respectively. The mill has been idle for two years waiting to be enlarged to a capacity of 10,000 tons per month, and for further developments. During the year ended Dec. 31, 1910, the reserves had been increased 218,000 tons of an average assay value of 11.4 dwt., as against a value of 12.9 dwt. at the close of 1909.

On March 31 the reserves were estimated at 458,580 tons of a value of 11.1 dwt. In addition, there are 293,000 tons of 3.4-dwt ore. The vein at the bottom level (2700 ft.) is 8 ft. wide and assays 15 dwt., which is said to be the largest orebody on the Tarkwa range, showing that with depth the vein is richer and that the oreshoots are longer. Another shaft, of four or more compartments is needed.

OTHER DEVELOPING PROPERTIES

The Prestea Block A mine is likely to call attention to the Coast mines in 1912 as it should enter the dividend list, and is regarded as one of the "trump cards." At the close of the year 110 stamps should be at work crushing 30,000 tons of 40-s. ore per month; the costs are estimated at 20s. or less, equal to a profit of £30,000 per month. The lode is reported to be 8 ft. wide for nearly a mile in length and assays 40s. per ton, with no poor or barren zones. The sinking of two shafts is now under way.

The Broomassie has not reached the dividend-paying stage, although at one time it was regarded as a promising mine and still may be considered such in spite of the bottom level (990 ft.) not yielding such good-grade ore as the lode between the 620- and 770-ft. levels. The winzes sunk below the 990 level have also been disappointing. The 20-stamp mill has been idle since October, 1909. The cost of working in 1908, excluding development, was 33s. 11d. per ton. There are two dredging companies, namely, the Ancobra, which produces about 600, and the Offin River, which yields about 1000 oz. per month.

Down-Draft Sintering Experiments

By A. W. Hahn *

Successful experiments on treating flue dust, lead matte, and speiss. Roasted material in good condition for blast-furnace work. Results on speiss especially noteworthy.

*Metallurgist, Campo Morado, Guerrero, Mex.

During September, 1910, a number of experiments were tried at the smeltery of the Reforma Mining and Milling Company, at Campo Morado, Guerrero, Mexico, with the object of utilizing a large accumulation of lead matte and flue dust, and of agglomerating sandy lead ores, without the use of a briquetting machine. The experiments were carried out under the direction of R. L. Lloyd, and the Dwight-Lloyd system of down-draft simultaneous sintering and calcining was used.

Apparatus

A cylinder 10½ in. high, with a diameter of 14 in., was cut of 1/16-in. sheet iron, the bottom edge being turned in at right angles. On the upper edge was riveted a ring of angle iron, 1x1¼ in., the wide side being at right angles and flush with the upper edge of the cylinder. A ½-in. circular iron casting, 15-in. diameter, was used as a cover. This was bored in the center, and threaded to take a 1-in. pipe. The air connection consisted of this 1-in. pipe, threaded into the cover, and extending into a pot for 2 in., and above the cover for 3 in. A tee was connected to the upper end of the pipe with a nipple on one end, for the blast pipe, and a reducer on the other, for a ¼-in. nipple for the pressure-gage connection. In order to make an air-tight joint between the cover and cylinder, a ring of ¼-in. asbestos packing was used, and the cover clamped to the angle-iron ring, by means of two pieces of ¼x1-in. iron, one on each side of the center of cover, and bored on the ends, to receive ½-inch bolts. The angle-iron ring was also bored in four places, to fit these holes in the clamps. The whole apparatus is simple, and can be made in a few hours.

Material Available

Before going further it is necessary to state that enough iron oxide had to be present in the resulting product, so that no iron flux would be necessary in the subsequent lead smelting. As is seen in the accompanying table, there was a variety of material available for the object in view.

The pyrite was all crushed by hand, to pass a four-mesh screen, the sandy ore was screened through this same mesh, and the oversize rejected. The flue dust was already fine enough, care being taken to crush any lumps. The matte and speiss was also crushed to pass a four-mesh screen.

MATERIAL FOR SINTERING EXPERIMENTS

Material	SiO_2, Per Cent.	Fe, Per Cent.	Pb, Per Cent.	Cu, Per Cent.	As, Per Cent.	S, Per Cent.	Zn, Per Cent.	C, Per Cent.	Ag, Oz. per Ton	Au, Oz. per Ton
Pyrite.....	8.2	39.3	1.2	1.2	2.7	43.2	3.7	...	6	0.2
Sandy ore..	30.1	22.6	12.6	trace	2.6	4.0	1.7	...	40	1.6
Flue dust...	28.6	14.3	24.0	...	2.7	4.8	...	9.0	30	1.0
Matte.....	....	45.0	14.0	0.4	5.8	23.0	...	...	65	0.3
Speiss.....	....	64.7	3.0	...	18.2	8.7	...	...	27	1.7

RESULTS OF SINTERING EXPERIMENTS

Experiment No.	Per Cent. Sintered	Mixture: Pyrite	Mixture: Ore	Mixture: Flue Dust	Time of Blow, Minutes	Depth Bed, Inches	Analysis of Product: SiO_2	FeO	As	S	Pb	Ag	Au
7	50	3	3	4	50	4½	....	....	....	....	....	....	...
8	50	2.5	3.5	4	50	2½	....	....	....	....	....	....	...
9	80	2.5	4	3.5	35	2½	....	....	....	....	....	....	...
11	75	2.5	5	2.5	42	3	29.6	34.0	1.3	3.2	15.6	44.0	2.1
15	85	3.3	3.3	3.3	36	3	....	....	....	....	....	....	...
16	100	4	3	3	30	3	18.2	42.4	0.8	7.5	15.9	45.0	1.5
17	90	4	6	0	48	2½	18.2	51.5	1.6	4.8	15.6	40.0	1.3
19	75	3	3	3 (a)	42	3	18.0	38.4	...	5.2	....	....	...
23	100	3	3	2 (b)	42	3	17.6	38.4	...	6.9	15.6	52.0	1.3
24	95	2.5	3	1.5 (c)	49	3	15.6	43.1	...	6.0	17.6	55.0	1.2
28	100	3	3	2 (d)	60	3	10.0	46.8	...	4.7	13.2	35.0	1.5

(a) One part matte added. (b) Two parts matte added. (c) Three parts matte added. (d) Two parts speiss added.

Experimental Work

In all, 28 experiments were made, and the number of successful and feasible mixtures was by no means exhausted. It is unnecessary to tabulate those runs which failed through lack of pressure, poor ignition or carelessness, for in operation on a commercial scale, these factors do not enter.

The various components of a mix were weighed out, and thoroughly rolled on canvas until uniform. There was sufficient moisture in the flue dust and ore, so that no water was added. A four-mesh screen cut to the interior diameter of the cylinder was placed on the bottom of the cylinder and rested on the turned in angle; on this was placed limestone cracked to about ⅜ in., to a depth of ½ in. This was only to prevent fines passing through, and not for any metallurgical reaction. On top of this was placed the charge to the required depth, and on top of the charge, a small amount of burning coal, well distributed, so as to insure an even start. A piece of screen 4 in. square was placed below the air-inlet pipe, as without this it was found that the center of the charge sintered too rapidly, and the edges not at all. When all was in readiness the cover was clamped on and the blast started. The apparatus was set on an empty slag pot, so that the gases had a free escape. The air supply came from the main blast pipe of the smeltery, which happened to have a 5-in. branch pipe, to which was attached a 1-in. iron pipe by means of a tuyere bag. The iron pipe was fitted with a globe valve for controlling the pressure, and was connected to the sinter pot by means of a rubber hose. The absence of any or only a faint fume, and the temperature of the pot, showed when the operation was complete.

Of the 28 mixes tried, Nos. 16, 23, 24 and 28, resulted satisfactorily. The product from the lead-smelting standpoint, both physically and chemically, was ideal. It was hard and porous, and at the same time, sufficiently strong to carry a reasonable overburden. The sulphur and arsenic were low, as shown in the accompanying table, and the iron high enough to flux high-grade silicious ores. The actual losses due to volatilization were not determined, but a rough calculation from the original mix and the finished product, showed this to be low. The loss due to dusting was negligible, and none of the mixes stuck to the screen after sintering.

Experiments Nos. 1 to 5, not given in the table, were mixes of pyrite and flue dust only, and were failures. No. 6 (not in table) was a mixture of pyrite, flue dust and ore, but there was too much flue dust present and it gave an incomplete roast. The flue dust in excess

acted as an insulator, and prevented the heat of the burning pyrite from spreading evenly. A perfect roast and sinter was obtained with the pyrite, ore, flue-dust combination in No. 16, while Nos. 11 and 15 are feasible mixtures.

No. 17 is an example of what can be done with an iron-lead concentrate and silicious sands, for the product has a big advantage over barren-iron flux in furnace. Nos. 19, 23 and 24, mixes with matte included, required less adjustment than the other mixtures. The failures under this set of experiments were due to too much flue dust and too little matte.

Speiss Easily Treated

No. 28 proved surprising. Speiss was substituted for matte in No. 23, and an excellent product was obtained, in fact, a perfect roast and sinter. The time element was the only variation from the data, when matte was used. It took longer to get the roast started, but when once started it apparently produced more heat than any of the other runs, due to the arsenic oxidation, and also to the oxidation of the greater amount of iron present in the speiss than in the matte. There is no reason why, with enough sulphur in the charge, and enough silica to give body and also act as a diluent, this process cannot do away with the speiss nightmare of the lead metallurgists. It is also my opinion that cobalt-nickel-arsenic combinations, rich in silver, can be successfully treated by combining the above method with a subsequent leaching operation, to recover the nickel and cobalt, and leaving the silver in the residues.

It is reasonable to assume that the results obtained in the small experimental apparatus can be duplicated, if not improved, when put into practice on a commercial scale. Other things being equal, the larger amounts of reacting materials will give a more constant and evener heat and a better product. The apparatus described is cheap, easily built, and lends itself admirably to laboratory work under practically working conditions. Further experiment along the lines of combined blast roasting and sintering will probably open a much broader field for the use of this method of preparing material for subsequent metallurgical treatment.

Garnet Milling in New Hampshire

By Earl S. Bardwell *

Garnet forms 40 to 50 per cent. of the rock and is recovered by dry concentration for use as an abrasive. Biotite can also be recovered by magnetic separators.

*Mining engineer, 1215 North Fifth avenue, Great Falls, Mont.

The garnet-bearing rock of the United Mineral Company outcrops near the top of Currier hill in North Wilmot, Merrimac county, N. H., covering an area of about an acre. The rock is of granitic nature and contains from 40 to 50 per cent. of garnet crystals. These are not well developed, are about ¼ in. in diameter and present a somewhat rounded appearance with inclusions of quartz and biotite. This fact renders it impossible to make a clean separation without fine crushing. After the garnet has been crushed and cleaned, the fracture appears sharp, the particles are hard and deep red in color, making it well suited for sandpaper purposes. The associated minerals are those common to granite; i.e., quartz, feldspar and biotite mica.

The rock is quarried and afterward broken by sledges into pieces convenient for feeding to the breaker. The broken rock is trammed a distance of about 600 ft. to the rock house which is located at the brow of a steep cliff. The cars run from the quarry by gravity, the last 100 ft. being over a trestle with a slight upgrade sufficient to check their momentum. Directly beneath the floor upon which the rock is dumped is a 6x10-in. Sturtevant jaw breaker, crushing to 1¼ in. This breaker makes 165 thrusts per min., has a capacity of six tons per hour, and requires seven horsepower which are furnished by a 15-horsepower, three-phase, 60-cycle, 220-volt General Electric induction motor making 1200 r.p.m. The broken rock falls from the breaker directly into the tramway loading bin beneath.

Gravity Aerial Tramway

The aërial tramway, furnished by the A. Leschen & Sons Rope Company, of St. Louis, is constructed in a single span 1200 ft. in length and delivers the rock to the mill bin, the elevation of which is 225 ft. lower than that of the loading terminal. This tram is of the two-bucket type and has a capacity of 30 tons hourly. No power other than that of gravity is required. The time of one man for about one hour daily is all that is required to keep the mill supplied.

The mill is a wooden structure covering an area of 50x36-ft., situated at the foot of the Currier hill about 200 ft. from the main road. It is a 2½-story building with a screening tower 12 ft. square near the front and rising above the roof. This tower has two floors above the third floor of the mill.

Crushing Department

The crushed rock is delivered by way of the aërial tram into a bin at the rear of the mill, 14 ft. sq. with bottom sloping at an angle of 45 deg. The top of the bin is on a level with the third floor of the mill. The rock is delivered by gravity to the crushing department.

The ore first enters a pair of Sturtevant balanced rolls, 26x15 in., making 82 r.p.m., and capable of crushing six tons per hour to ⅜ in. The rolls are on the first-floor level and rest upon a solid concrete foundation. From these rolls the product is taken by a bucket elevator, 16 ft. between centers. The 8-inch 6-ply rubber belt has 6x4-in. malleable-iron buckets spaced 18 in. apart. The belt runs at 300 ft. per min., and delivers the crushed rock to an American Process Company drier. The revolving cylinder is 21 ft. in length and makes 17 r.p.m., and is driven through a sprocket and chain. Soft coal is used as fuel, but little fire is needed as the rock is ordinarily fairly dry. It is warmed to remove any superficial moisture and to promote screening.

The revolving cylinder of the drier projects into a reinforced-concrete dust chamber which extends through the side of the mill. This chamber is 12x12x 12 ft. in outside dimensions with roof and sides 10 in. thick. The roof is flat and is reinforced with ⅝-in. twisted steel rods spaced 4½ in. on centers. The rods were 14 ft. in length originally but were bent at each end so as to give them an 18-in. bearing in the side walls. The dust chamber supports the 24-in. steel stack 50 ft. in hight. The drier delivers the sands through a chute in the side wall of the dust chamber to another bucket elevator, while the dust which settles in the dust chamber is removed from time to time through the cleaning door outside the mill. The dust is discarded for the reason that it contains almost no garnet.

The second elevator delivers the sand to a No. 3 Newaygo separating screen making 90 r.p.m. The screen cloth is 4 mesh, 14 wire and is set on a slope of about 45 deg. The oversize (over 2 mm.) goes by chute to a pair of Sturtevant balanced rolls, 26x15 in., set to crush to 2 mm. and making 100 r.p.m., the product going with the undersize to the separator bin, from which material under 2 mm. is delivered to the separating department by a belt elevator.

The crushing department is run by a 50-h.p., three-phase, 60-cycle, 220-volt

General Electric induction motor making 1200 r.p.m. The crushing department may be run independently or may be closed down at any time without interfering with the operation of the rest of the mill. It is usually run about four hours per day and during this time is capable of crushing enough rock to keep the separating department supplied during the entire 10-hour run.

Separating Department

The crushed material first passes through a No. 3 Newaygo separating screen. This screen is situated upon the upper floor of the screening tower and has two sieves; the upper screen is 6 mesh 16 wire and the lower is 10 mesh 20 wire. This screen make two oversize products, i.e., through 2 mm. on 1.4 mm. and through 1.4 mm. on 0.75 mm. These products go by way of chutes to table bins on the third floor of the mill. The undersize of 0.75 mm. goes to another Newaygo screen on the floor below. This separator has one seive, 24 mesh, 29 wire. Two products are made, 0.36 to 0.75 mm. and under 0.36. The 0.36 to 0.75 mm. size goes to a third table bin, and the under 0.36 mm. size goes to waste.

The material from 1.4 to 2 mm. in diameter goes to a Sutton, Steele & Steele dry-concentrating table. This table makes 390 thrusts per min., has a capacity of about 3000 lb. per hour, and requires approximately ½ h.p. It delivers garnet through a spout to the sacking room in the basement of the mill, middlings to the second Newago screen, and tailings by screw conveyer out of the mill. Air is supplied to the table by a No. 10 Green blower making 500 r.p.m. and belted to the line shaft The material from 0.75 to 1.4 mm. in diameter from the first Newaygo, and that from 0.36 to 0.75 mm. in diameter from the second Newaygo are treated alternately on a second Sutton, Steele & Steele dry-concentrating table. This table makes 425 thrusts per min., has a capacity of about 1500 lb. per hour, and requires approximately ½ h.p. The delivery of products is the same as from the first table. Air is furnished to this table by a No. 6 Green blower making 965 revolutions per minute.

The tailings from these tables are practically free from garnet but contain about 25 per cent. of biotite. A Wetherill magnetic separator has been provided to save this biotite but so far nothing has been done with the product. The separating plant is run by a 15-h.p., three-phase, 60-cycle, 220-volt, General Electric induction motor making 1200 revolutions per minute.

Sacking Room

The sacking room is in the basement of the mill. The garnet is shipped in canvas sacks each containing 100 lb. The company has a freight house at South Danbury, N. H., three miles distant, with capacity for storing 400 tons. Here the garnet is loaded directly into the cars. The plant is at the present time producing garnet at the rate of 12 tons in 10 hours.

The power plant is situated about 1¼ miles from the mill at a point where there is a plentiful supply of water for boiler purposes. The equipment consists of a 120-h.p. Hodge locomotive-type boiler supplying steam at 100-lb. pressure to an 80-h.p., simple, non-condensing, high-speed American Ball engine direct connected to a 75-k.v.a., three-phase, 60-cycle, 2300-volt, General Electric alternator. The transformers for the motors at the mill and at the quarry are placed outside the mill in a separate building.

There is a machine shop on the first floor of the mill building. This shop is equipped with a Fay & Scott engine lathe, emery grinders, drill press, and all tools necessary for repairs about the plant. The machine shop is so arranged that it may be operated by a gasolene engine at times when the power plant is not in operation.

Smelting at Tennessee Copper Company

During the year 1910 the Tennessee Copper Company at Copperhill, Tenn., smelted material as shown in the accompanying table.

FURNACE BURDEN IN 1910

Material	Tons
Tennessee Copper sulphide ore	424,197
Custom ore	31,536
Converter slag	8,768
Blast-furnace slag	27,193
Sintered flue dust	8,867
Quartz flux	59,521
Limestone flux	26,632
First matte	100,698
Total	687,412

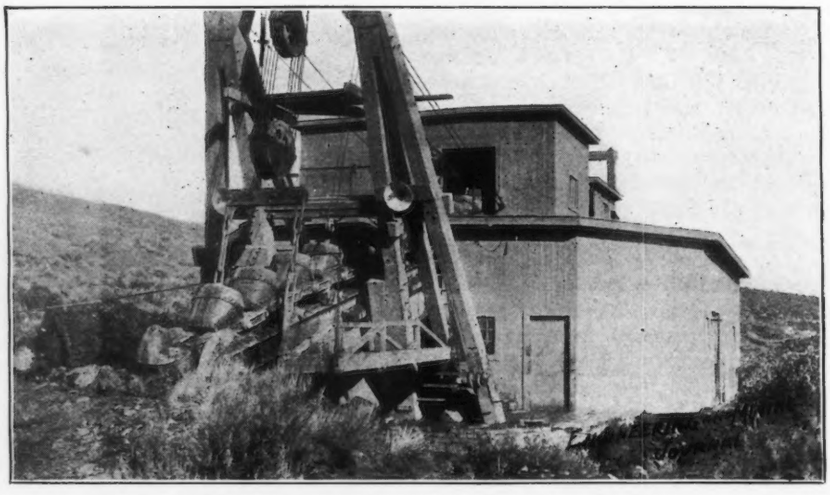
From this table it appears that the charge is made up as follows: Revenue-bearing material, 66.30 per cent.; barren fluxes, 12.53; returned products, 21.17 per cent. The coke is 8.81 per cent of the revenue-bearing material; 7.41 per cent. of the ores and fluxes; and 5.84 per cent. of the charge.

The annual report of the company shows a smelting cost of $1.227 per ton of ore, which indicates that smelting is being done at the Copperhill plant at $0.814 per ton of charge. This does not apparently include any portion of the Copperhill general expense, and is, of course, exclusive of converting.

First Gold Dredge in Nevada

By H. G. Walker*

The recent installation and present successful operation of a gold dredge in the desert region of Nevada should demonstrate to the mining public the possibilities of the modern dredge for the recovery of placer gold. The opening of Nevada goldfields to dredging operations was begun about the middle of November, 1910, in Spring valley, Humboldt county, 30 miles from Lovelocks or 130 miles northeast of Reno. This cañon, on the east slope of the Humboldt range, together with the neighboring cañons, Dry gulch and American cañon, has been worked for the last 35 years by Chinamen. The former method of working was to sink a shaft and hoist the gravel by a whim, then extract the gold by rocking, a slow and tedious process, but one which the value of the ground and patience of the Chinamen seems to have warranted.



Federal Gold Dredge Operating Near Lovelocks, Nev.

Dredging Conditions Difficult

A thorough prospecting of the workable ground remaining showed it to run about 30c. per cu.yd., which estimate has been borne out by subsequent operations. The grade of the cañon is steep and there is a considerable rise from the south to the north rim. The depth to bedrock varies from 20 to 30 ft. and the overburden is a fragmental gravel containing

*Lovelocks, Nev.

many large granite porphyry and rhyolite boulders, while the bedrock itself is a hard limestone of a blue color.

There is little water, the supply being piped from a ranch on Indian creek, five miles distant, and considerable difficulty was experienced in floating the boat. Underground tunnels and stopes have several times threatened to drain the pond, which has been saved each time by prompt attention and hard work. The ground and boat are owned by the Federal Mines Company, of Chicago. Charles R. Clark, of Montezuma, Iowa, is president and W. Gilbert, of Chicago, secretary-treasurer. J. H. Hart, formerly of the Risdon Iron Works, is superintendent and has had a broad experience in both the construction and operation of dredges in this country and West Africa.

Details of Dredge

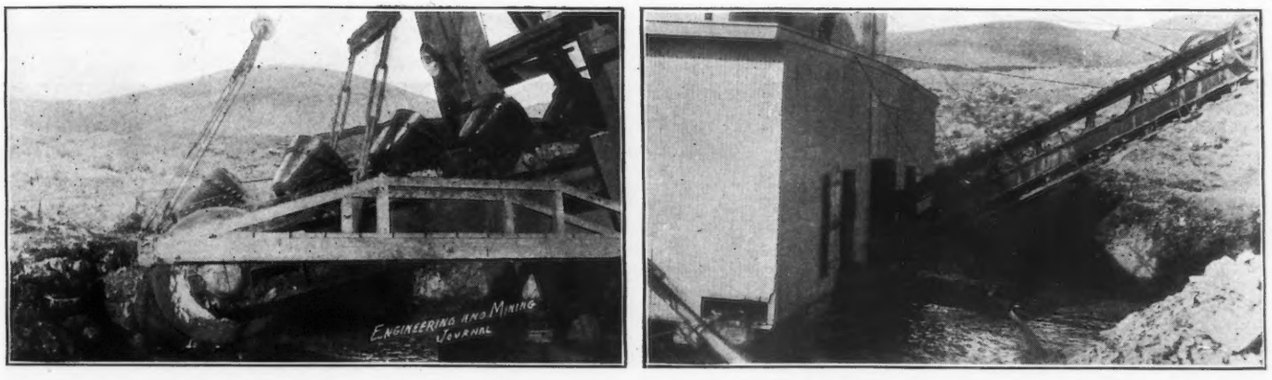
The dredge is operated continuously by a crew consisting of three winchmen, six oilers, three engineers, a blacksmith and helper and a couple of laborers. Three shifts are worked per day. The boat was built by the Risdon Iron Works, of San Francisco, and embodies several distinctive features. The ladder line is of the bucket and link or open-connected type, having 28 five-foot buckets with manganese steel pins and lips, a type best adapted to ground containing large boulders. The digging capacity is 2000 cu.yd. per day. The stacker consists of a continuous chain of 70 buckets, close connected, and is driven by rope transmission from the main drive. The power used on the boat is furnished by four engines of 8, 30, 55 and 100 h.p. rating respectively, made by the Doak Gas Engine Company, of Oakland, Cal. The 8-h.p. engine drives the dynamo for lighting the boat and a small pump for priming. The 30-h.p. engine drives the winch, the 55 the double 10-in. centrifugal pumps and the 100 the main drive, which operates the bucket line, screen and stacker. Owing to the altitude, over 5000 ft. above sea level, the total effective horsepower is somewhat below the rating, an efficiency of only about 81 per cent., or 156 h.p. being obtained. The main-drive engine is a four-cylinder Doak of the marine type. The winch engine drives a friction side-line winch and an independent ladder and head-line winch. No spuds are used for anchorage, a head line being provided to hold the dredge to its work.

The fuel used is No. 1 engine distillate and is hauled from Oreana, Nev., a distance of 14 miles over a steep mountainous road in drums of 100 gal. capacity. This means an enormous item of expense, but is the only practical source of power.

The gravel being thoroughly washed through a revolving screen or trommel, falls on tables having angle-iron riffles sloped one foot in fifteen. There are 40 ft. of tables, 6 ft. in width in addition to 32 ft. of riffles in the sluices. The gold is coarse, owing to the short distance from its origin and $3 to $5 nuggets are common.

The working season lasts the entire year and although there was much freezing weather in December and January, there was not a single shutdown from that cause.

The success attending the early operations of the Federal dredge would seem to indicate that Nevada would add materially to her future production of gold by extensive dredging operations. Profitable working of this ground will undoubtedly hasten the instalment of dredges in Dry gulch and American cañons.



Open-connected Bucket Chain and Close-connected Tailings Stacker on Federal Dredge, Near Lovelocks, Nev.

Recovering Zinc from Galvanized Scrap

The acid baths commonly employed for dissolving zinc from scrap galvanized iron have the disadvantage that they dissolve a large amount of iron, involving not only waste of acid, but also the difficulty in separating the iron from the solution without loss of zinc. The baths as usually composed contain about 20 per cent. zinc, and 5 to 7 per cent. of iron. The Goldschmidt process, described in *La Revue des Produits Chimiques*, Jan. 10, 1911, overcomes this objection by the use of a neutral or even basic bath of zinc chloride, which dissolves zinc but has no effect on iron, thereby entailing the incidental advantage that iron vessels can be used in the process.

When ready for use, the bath contains about 24 per cent., by weight, of zinc, but only 25 per cent. of chlorine instead of the 26 per cent. theoretically demanded for a neutral solution; such a solution is said to be 1 per cent. basic. After a period of dissolving, the excess of zinc may rise as high as 3 or 4 per cent. A small amount of iron will ordinarily go into solution, not by corrosion of the iron sheet, but by dissolving the iron-zinc alloy close to the surface of the sheet; the proportion of iron so dissolved averages 0.4 per cent. of the total weight of scrap, or about 1 per cent. of the weight of the bath, which is not more than a sixth of the proportion of iron dissolved by the ordinary acid bath.

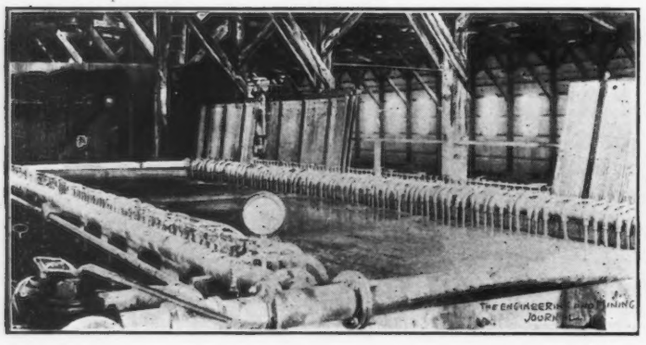
In operation, the galvanized scrap is put into an iron basket, cleaned if necessary, and freed from solder, then introduced into the above-described bath maintained at boiling temperature, and agitated until hydrogen ceases to be evolved. The amount of liquid is so adjusted that after treatment it will be only 2 or 3 per cent. basic. Iron can then be precipitated by any common method, as, for example, by the addition of chloride of lime. After each operation, a part of the bath is drawn off, and to the remainder is added enough hydrochloric acid and water to reduce the basicity to about 1 per cent., when it is ready for the next charge of scrap. The cleaned iron scrap is carefully washed in one or more waters, this wash water, and that with which the precipitated iron has been washed, then being utilized in preparing the succeeding chloride baths. As an example, one ton of scrap, of about 10 per cent. zinc, would be submerged in about six cubic meters of a solution containing 24 per cent. of zinc and 25 per cent. of chlorine, or 1 per cent. basic; after treatment the solution would be about 3 per cent. basic, and would require the addition of 350 to 400 kg. of commercial hydrochloric acid to restore it to normal working condition.

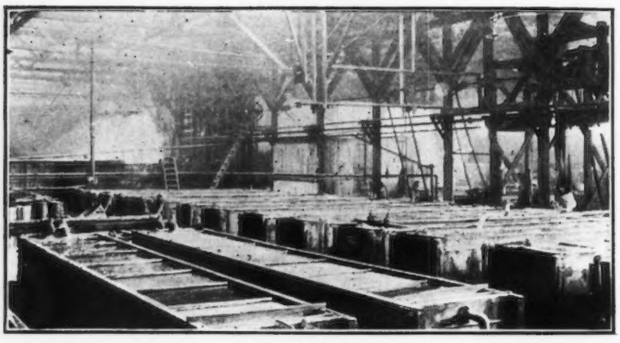
Tonopah Mining Company's Mill

By Claude T. Rice

By double treatment of sands and addition of air lifts to old mechanical agitators, extraction has been raised to that characteristic of the all-sliming plants of the district; treatment costs, $2.94 per ton on $22 ore.

The Desert mill of the Tonopah Mining Company, at Millers, Nev., was the first one built to treat Tonopah ores, having been finished in the fall of 1906. Some of these ores had already been shipped to the Butters mill at Virginia City, and as this mill had worked well on them, it was natural for it to be taken as a model; hence one finds at the Desert plant sand wheels, Blaisdell system and other features characteristic of Butters' practice at Virginia City. The ore to be treated is oxidized. This has both its advantages and disadvantages; for instance, there is more manganese in the oxidized than in the sulphide ores of the district. Sometimes the manganese in the head is as high as 1 per cent., while there is always ¼ per cent. of manganese present. The oxidation that increased the manganese content also removed some of the arsenic and antimony, but not enough to counterbalance the increase in manganese content. There is a large amount of alumina in the oxidized ore from the Tonopah veins, being approximately 90 parts of silver to one of gold. The chief gangue mineral is quartz and there is also some orthoclase. Much red oxide of iron is found in the oxidized ore, although little pyrite or chalcopyrite occurs in the unoxidized ore. The gold in the oxidized ore is more difficult to dissolve than in the sulphide ores of the district, although the reason for this peculiarity is unknown.





BUTTERS FILTER AND PRECIPITATING BOXES, DESERT MILL, TONOPAH, NEV.

decomposition of the adularia. This makes it difficult to clarify solutions from the sand plant and gives trouble at the filters, because of the rapidity with which the leaves become choked with a coating not readily soluble in hydrochloric acid. This quickly rots the sewing, and the canvas itself deteriorates more rapidly than with the otherwise similar but unoxidized sulphide ores of the district. In fact, this deterioration even extends to the wood of the filter leaves, so that not one of the original filter frames is now about the plant.

OCCURRENCE OF SILVER AND GOLD

In the oxidized ore some of the silver occurs as chloride, but mainly as sulphides. There is much argentite, some pyrargyrite, but most of the silver still occurs as stephanite and polybasite, as in the strictly sulphide ore of the district. The gold occurs partly as native gold, but most of it is locked up in the sulphides. The proportion of gold to silver is the same as that in most of the

The necessity of crowding the mill so as to get the maximum profit from the ore is not conducive to the best metallurgical result, although it results in an increase of about 4 per cent. in the net profit, owing to economies resulting at the mine from increase in tonnage. Of course, if it were practicable, it would be better to increase the milling capacity, rather than to economize by crowding the mill at the expense of extraction, but that is now impracticable, and it is necessary at the Desert mill to make the best of the equipment at hand, sand plant and all, just as is the case at many another of the early silver-cyaniding plants.

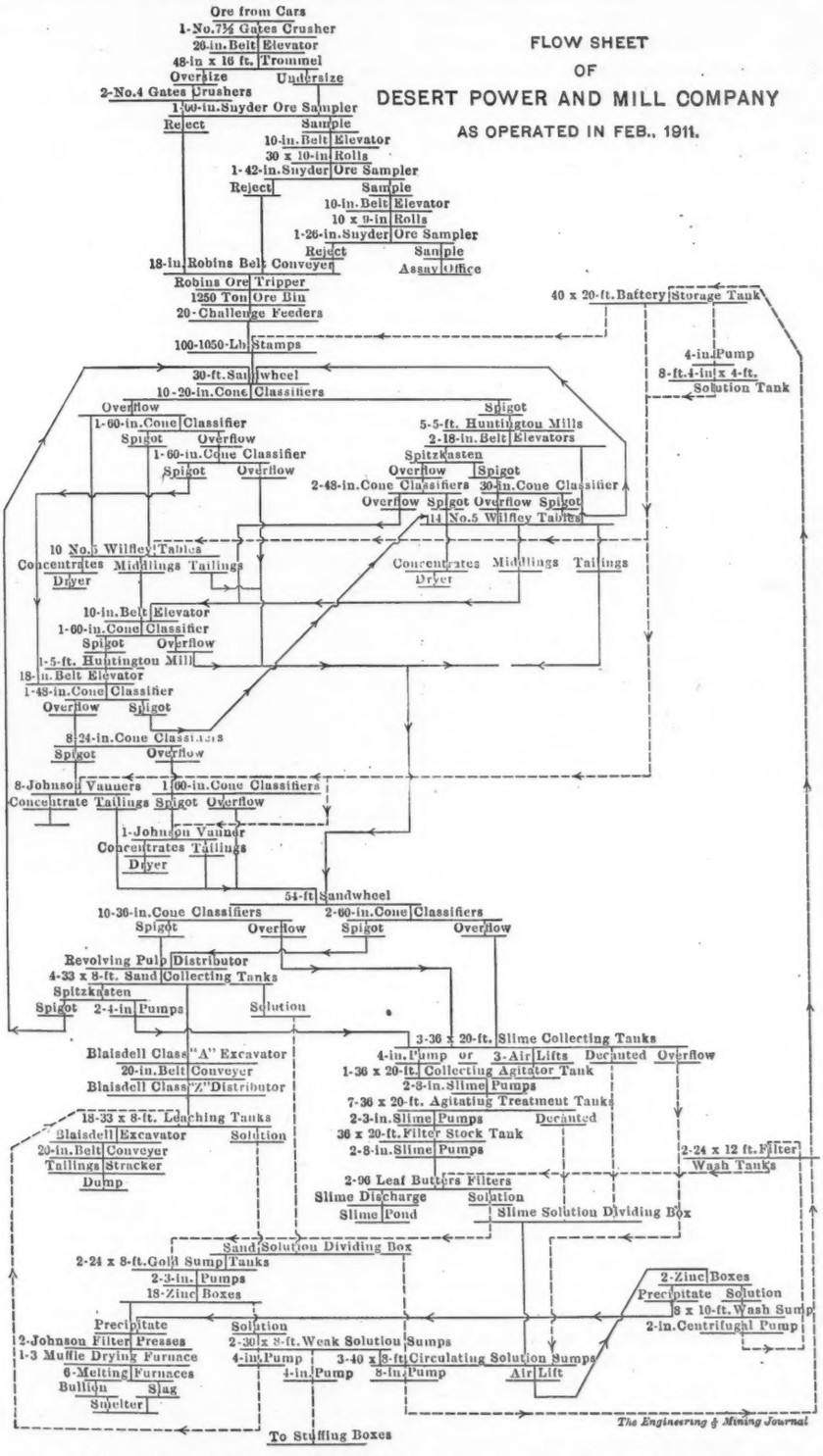
SAVING OF 90 PER CENT. ON $22 HEAD

But, in spite of these disadvantages, the mill is making a saving of from 90 to 92 per cent. on a $22 head, and the milling costs are the lowest in the district, even if two of the plants are using all-slime treatment with its much more economical use of labor. To accomplish this required the utmost attention to details. Double treatment has increased the efficiency of the sand leaching, while the addition of air lifts to the flat-bottomed tanks, in order to give a better aëration of the pulp and to increase the agitation of the slime, had made the flat-bottomed tank almost as efficient as Pachucas in the matter of extraction, though not so efficient from the mechanical standpoint. The efficiency of the treatment has also been increased by heating the solution, the added recovery due to this being estimated at 2 per cent. This heating, which was first tried at the Desert plant in the fall of 1906, will probably become in a few years as characteristic of silver cyanidation as is now the aëration of solution, for even in Mexico, with its much warmer climate, the importance of the temperature of the solutions is being recognized. Heating is expensive, but it pays with high-grade ores, even when the cost of fuel is high, as at Tonopah.

The Desert mill is equipped with a good sampling mill, and it is possible with the oxidized ore to get reliable samples. By using the head sample it is possible to keep somewhat closer account of milling operations than is the case where the extractions are calculated by using as the head the sum of the precious metals in the tailings and in the bullion and concentrates; for in the latter method of calculation no light is thrown upon plant losses like those resulting from spilling solution, passing away of valuable solution in tailings, theft, as well as many other small but important losses that can intervene between the ore bin and the ingot mold.

The ore from the railroad car is dumped into a small bin, whence it goes to the crushers and samplers; the course of the ore until it reaches the battery bin with a maximum diameter of 1¼ in. is quite clear from the flow sheet. From the battery bin, which holds 1500 tons,

the ore is fed by modified Challenge feeders to the stamps, 100 in number. These are arranged in groups of 20, each of which has its separate driving motor, while each set of 10 stamps is driven by a separate belt from the group line shaft. The stamps weigh 1050 lb. and



make 104 drops per minute. The hight of drop varies between 6 and 6½ in., while the hight of discharge is between 2½ and 3 in. A Tyler ton-cap screen is used on the batteries, No. 63 having an opening 0.04 in. wide. Crushing through this size of screen the stamps have a duty per 24 hours of 5.09 tons.

Chrome-steel Shoes Used

On the stamps chrome-steel shoes are used, as they have been found more efficient than shoes of other metal. The dies are castings from the Tonopah foundry to which the company sells its scrap iron and steel. These dies contain some manganese and are cheaper than the chrome; moreover, shoes and dies wear better when not identical in composition. The consumption of metal in the batteries is 0.368 lb. of shoe steel per ton of ore milled, while the consumption of die metal is 0.509 lb. The cost for shoes is $0.021 per ton milled, but for dies it is only $0.0185, on account of the cheapness of the die metal. The screens last well with this ore, having a life of about 50 days. Ore is crushed in cyanide solution which has a strength of 5 lb. per ton. It is known that a quicker and probably better extraction could be made if the crushing were done in water instead of in the cyanide solution, but in order to crush in water, dewatering devices would have to be installed. When crushing is done in cyanide, the gold and silver dissolve rapidly at first, so that 20 per cent. of the precious metals in the ore is dissolved by the time that the cyanide department proper is reached. But unfortunately after 48 hours the solvent action slows up and for a period of about 20 hours there is little or no solution of gold or silver. Then the action is resumed as if there has been a breaking-up of compounds difficultly soluble in cyanide. No such retardation, or at least none so pronounced, has been noted when pulp crushed in water was experimented with, although in the laboratory this same retardation is noted when making tests on pulp crushed in cyanide. It is possible that this retardation is due to reprecipitation, as the same phenomenon of slow solubility is characteristic of all the pulp that accumulates about the plant; for instance, on the bottoms of the agitators. Possibly particles of iron from the shoes and dies are the cause, as a somewhat similar phenomenon has been noted in hyposulphite lixiviation, and it is there ascribed to such a cause. About 6½ tons of solution are fed to the batteries per ton of ore. A portion of the lime is added at the stamps.

Cheap Upkeep for Sand Wheels

The pulp from the batteries goes to a sand wheel 30 ft. in diameter which feeds the pulp to cone separators that separate the feed into an overflow pulp to be treated on Wilfley tables and a coarse underflow which is reground in 5-ft. Huntington mills, five in number, before being concentrated. The overflow from the cone goes to 10 Wilfley tables which make concentrates, middlings and tailings. The concentrates go to a draining board and then through a drier before shipment, while the middlings go to a Huntington mill for regrinding. All middlings about the plant are reground as they contain the most refractory part of the ore.

The Tyler ton-cap screens used on the Huntington mills have openings 0.02 in. wide and last about five days. Midvale steel is used for the runners on the mullers as well as for die rings. The cost of regrinding in the Huntington mills is about 17c. per ton of mill feed, while per

ton of product crushed in the mills it is 52c., 21c. per ton being for repairs. It may be added in this connection that the cost of repairs throughout the entire mill amounts to 51c. per ton of ore. The reground middlings, together with some of the finest of the overflow from the separating cones, go to nine Johnston vanners for reconcentration. The concentrates from the different devices have about the same analysis and assay 5.539 oz. per ton in gold, and 803.99 oz. per ton in silver, and for the year 1910 contained 13.27 per cent. of the gold and 21.53 per cent. of the silver that is saved.

All Concentrates Dried

Before shipment the concentrates are thoroughly dried. First they are placed on a draining board which consists simply of planks having a slope of ⅜ in. per ft., upon which the concentrates are piled in a layer about 8 in. thick, where they drain for about 20 hours. The drained concentrates, which contain about 15 per cent. of moisture, are then shoveled to drying plates where they are dried to about 3.4 per cent. moisture. This drying plate is heated with coal and wood, the wood being used to give a long flame. The coal costs about $13.50 per ton, while the wood costs $9.50 per cord. About four tons of concentrates are made per day and it costs 84c. per ton to dry them. This, however, pays well, not only because of the saving in freight which is about $18 per ton of concentrates, but also because dry concentrates are more accurately sampled than wet. A suction filter cannot be used, as much of the sulphide in the concentrates from this oxidized ore is the easily decomposed pyrargyrite and argentite, so that the sulphuric acid which would be formed would rapidly eat out the canvas on the filters.

Broken Vanner Belts Vulcanized

The tailings from the vanners, together with the tailings from all the Wilfley tables, go to a 54-ft. sand wheel which raises the pulp to the cone that separates the feed going to the cyanide plant into sand and slime. This large sand wheel raises about 3900 tons of pulp per day to a hight of 52 ft., and only requires 7½ h.p. to run it, while the small sand wheel which raises about 3200 tons of pulp per 24 hours to a hight of 32 ft. requires 5 h.p. to operate it. Both wheels give great satisfaction, and the cost of their upkeep does not amount to $50 apiece in a year.

The cones are run so as to give an overflow of slime containing about 10 per cent. that is coarser than 200 mesh, while the underflow of the sand contains considerable slime. The slime is separated from the sand thoroughly at the collector where practically all slimes drain off while the charge is being gathered. The overflowing slime, together with the finest of the sand, goes to a small spitzkasten which sends its overflow to the slime plant while the sand underflow is returned to the first sand wheel and then is passed through the concentrating system again, so as to remove any of this product which may be true middlings that escaped concentration.

A collector is filled in about 20 hours and is allowed to drain about 52 hours. These collectors, four in number, are the same size as the leaching tanks, 33 ft. in diameter and 7 ft. deep above the filter. These hold about 220 tons of sand as charged and in the running of the mill equal parts of sand and slime are made. The collectors are filled by means of a Butters distributer. The drained sands are transferred and charged to the leaching tanks by means of a Blaisdell system of transfer. In the complete sand treatment there are two of these transfers, for the sands receive a double treatment so as to obtain a good aëration of the pulp.

Details of Leaching

A 6½-ft. leaching column is used. Lead acetate is added at the different transfers, 25 lb. at the first transfer, or about 0.2 lb. per ton of charge, and at the second 15 lb. or approximately 0.12 lb. per ton of charge. The cyanide consumption is made up by using a strong-solution leach during the first 24 hours. This solution is circulated over the charge by means of a 1¼-in. air lift attached to each tank, so as to enrich the solution as well as to aërate it. This strong solution contains about 7 lb. of cyanide per ton, as charged on the tank.

The remaining five days of the first treatment are taken up by a leach with precipitated mill solution, which contains about 5 lb. of cyanide per ton. The charge is then transferred to the second treatment tank and given a leach for 24 hours with a strong solution containing 6 lb. of cyanide per ton. This solution is circulated for 24 hours as in the first case, and then the sands are given a leach with weak solution for about six days, as the tank capacity limits the treatment to 14 days from collector to discharge. At the end the sands are given a wash with from 30 to 40 tons of water and are allowed to drain for about 12 hours with a 5-in. vacuum under the filter bottom. As a result, the sands contain about 15 per cent. moisture when discharged. This is done by means of the Blaisdell system and tailings stackers, as the mill, on account of the topography, had to be built on a level site.

About 2500 Tons of Solution Precipitated Daily

About 1200 tons of solution pass through each ton of charge in the complete treatment. The strong solution is all precipitated while the weak solution leaches are precipitated for the first two days and as much longer as they continue to assay higher than the mill circulation. This latter is kept as near $1.90 per ton as possible and is seldom allowed to exceed $2.50 per ton. This necessitates the precipitation each day of from 400 to 600 tons of leaching solution, 600 tons from the solution drawn off at the slime collectors, and 1300 tons of solution from the agitators and Butters filters. A peculiarity of the ore is that, although the last solution put on the sand does not contain more than 5 lb. of cyanide per ton, this solution when it drains from the charge contains 7.6 lb. of cyanide per ton. The sand tailings as now discharged assay 0.034 oz. gold and 3.18 oz. silver per ton, having an assay value of about $2.36, with silver at 52c. per oz. As the sand going to the tank assays about $9.16 per ton, a saving of about 74 per cent. of the gold and silver in the sand is made. In the leaching department the temperature of the solutions is allowed to drop to about 70 deg. F., as it would cost too much to keep it higher.

Slime Treatment

The slimes from the main separating cone are collected at the slime plant in three thickening tanks, two of which are generally collecting while the third is discharging. Formerly there were five collecting tanks, but it has been possible to cut out two of these and to use them for agitation. This has enabled the agitation to be lengthened from a period of 60 hours to an average of 86 hours. The collectors are of about the same size as the agitators, 36-ft. diameter and 20 ft. deep. The overflow is returned to the mill solution, while during the decantation about 600 tons of solution are sent per day to the zinc boxes to be precipitated. The pulp is thickened to about 1.145 sp.gr., corresponding with this ore to 79 per cent. moisture, and is then transferred directly to the agitators, where it is treated. Approximately 3500 tons of solution are settled each day at the thickeners.

The agitators are of the old arm type and the tanks are flat bottomed. Several ways of improving the agitation have been tried, and in fact there are at present three different types of agitators in use at the plant, but the one that has been found to work most satisfactorily has the arm agitator and four air lifts. These are set in the tank near the sides and are equipped with discharge launders at the top. From two of the air lifts, the discharge lips extend only 2 ft., while from the third the discharge launder extends half-way and from the fourth all the way to the center of the tank. This is done so as to distribute more easily the coarser and heavier particles that are inclined to settle rapidly. These air lifts consist of a 10-in. outer box and a ½-in. air pipe, which discharges from its

full section under a pressure of 20 lb. per sq.in. The arms of the agitator rotate at 5 r.p.m. So about 4 h.p. is required to rotate the arms, while about 6 h.p. is represented by the compressed air supplied to a tank. The tanks, as charged, hold approximately 140 tons of dry slime or 660 tons of pulp. The main agitation is obtained by means of the air lift, while the agitator arms are used principally to prevent the pulp from settling on the bottom between the air lifts. By combining the two an effective agitation is obtained together with a good aëration of the pulp.

The Trent Tank

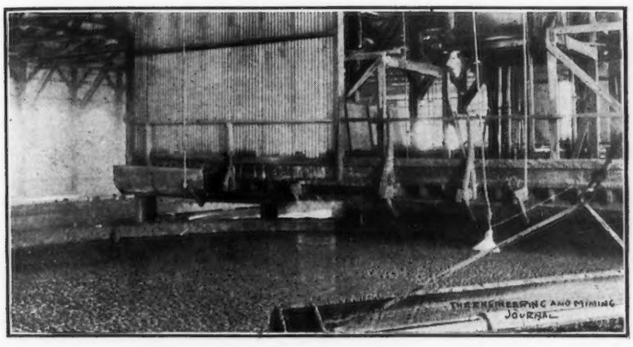
The most serious competitor of this type of flat-bottom agitator is the Trent. This does satisfactory work and is a good means of bringing flat-bottom tanks up to an efficiency comparable to that obtained with Pachucas. The Trent agitator consists of rotating pipes attached to which are nipples through which the pulp is sprayed out over the bottom as in a garden sprinkler, the speed of these issuing jets keeping the heavier particles from settling on the bottom. In order to aërate the charge and to aid in agitating it, air is fed in with the pulp going to the arm. This is done either by means of a separate air compressor, as is the case of the large installation at the Tonopah Extension mill, or by sucking air in with the pulp at the suction inlet of the circulation pump used, as is the practice in small installations. The feed for this centrifugal pump is drawn off from the tank at the top and is returned to the rotating arms at the bottom of the tank through a downcomer pipe in the center of the tank. This manner of adding the air to the charge results in comminution of the air particles into innumerable bubbles about the size of a pea. The intimacy of this aëration is best shown by the fact that in order to get the air out of the charge before it is sent to the Butters stock tank, the air inlet on the circulating pump is closed for two hours before the tank is discharged, and the pulp kept circulating by means of the pump, but without addition of air. Moreover, when the tank is started there is a notable swelling of the charge due to included air bubbles. The pump used on the Tonopah Mining Company's Trent agitator has a 6-in. inlet and a 7-in. discharge, and is run at 600 r.p.m. by a 10-h.p. motor. The steam used in heating the solution is also supplied to the tank through the suction of this pump, along with the air.

The pulp is agitated in the Trent at the same specific gravity as in the other agitators, and the length of agitation is the same. Up to date the Trent had made practically the same extraction as have the others, but prior to November it was fitted with an overhead feed instead of the present underfeed which gives a much better operation to the agitator. Whether there will be any better extraction now, it is too soon to say. The liners and runners of the circulating pump last about three months. The main expense of repairs is not so much the cost of these liners, but the necessity of shutting down the agitator for about seven hours so as to make the repairs. This could be avoided in large installations by keeping a spare pump on hand ready to take the place of any pump that was giving serious trouble or which needed to be relined. So far the Trent agitator has not been tested thoroughly enough to tell whether there is any real advantage from the fine comminution which the air receives and the intimate mixture of these air particles with the pulp that takes place during the agitation. An accompanying illustration shows the characteristic pebbly surface of the scum which forms on top of the tank soon after it starts. The bubbles of air are so small in the pulp that they do not break through this scum until considerable air accumulates and forces itself through as a larger bubble.

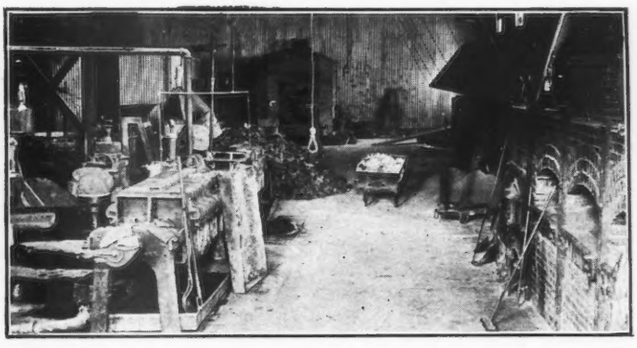
At the agitators, lead acetate is added in three parts, 15 lb. at the start, 10 lb. at the end of 36 hours and 5 lb. just before the pulp is discharged to the stock tank. This stock tank is also equipped with air lifts having floating discharge lips. The solution is made up to a strength of 5½ lb. at the agitators, and enough lime is added to give a protective alkalinity of about 1 lb. per ton. The agitation lasts 86 hours, and the temperature of the solutions is kept at about 90 deg. F. by means of a steam coil placed in the agitators. The slimes coming to the agitators assay $9.69 per ton, or about 14 oz. of silver and about 0.13 oz. of gold, while the tails at the Butters filter assay as discharged and unwashed 0.028 oz. gold and 2.49 oz. silver, or $1.87 per ton. So, in the slime plant a saving of from 80 to 84 per cent. is made calculating from slime-plant head to filter tails.

The Filter Plant

There are two filter tanks of 95 leaves each. These are run in parallel and air is used in each of the three bottom hoppers to keep the heavier slimes from settling, while the circulating of the pulp through the distributor pipes is done by air lifts. The wash water used at the Butters filter is precipitated after it goes to a separate head tank, from which it is pumped by a small air lift to zinc boxes that treat this solution only. After precipitation it is returned to the wash-water tank by means of a 2-in. centrifugal pump. As a result of this precipitation the Butters wash solution never builds up to more than 20c. per ton.



Surface of Trent Agitating Tank



Refinery of the Desert Mill

Filter Cycles

A cake from ¾ to 1 in. thick is made on the filters, and the cycle is 3 hr. 12 min. long. Collecting the cake takes 45 min.; running back stock pulp, 12 min.; running in wash water, 10 min.; displacing wash water by barren solution, 75 min.; dropping cake, 12 min.; decanting the wash, 11 min.; pumping residues, 12 min. As this filter was one of the first Butters installations after the early ones at the Combination mill, at Goldfield, and the Butters plant, at Virginia City, nothing can be dumped and everything has to be pumped. The filter leaves are washed in hydrochloric acid once every three weeks and are in the acid 18 hours at each wash. During that length of time the acid is alternately forced and sucked through the leaves, an automatic tripper changing the direction of the flow. Great trouble is experienced with the filter leaves, as a residue composed of calcium, aluminum and manganese oxides and carbonates builds up on them. This is so hard to dissolve that it is not

completely removed even by this long hydrochloric-acid wash. On account of the deterioration of the stitching of the canvas, a crew of four men is employed on Butters filter repairs and most of their time is taken up in working on the filter leaves. Several different types of filter leaves have been tried, but none of them has proved entirely satisfactory. The company has found it best to make its own filter-leaf frames and to use on them a 12-oz. canvas cover furnished already sewed by Channon & Co., of Chicago.

Precipitation

There are 20 precipitation boxes, 19 of which have seven and the other six compartments. Each box holds 105 cu.ft. of zinc. The head solution going to the boxes assay about 0.052 oz. gold and 4 oz. silver per ton (about $3); while the tail-solution assays vary from 4c. just after a cleanup to 30c. per ton just before. The short zinc is taken out on a 16-mesh screen and that which is caught on this screen is returned to the first compartments of the different boxes between layers of zinc shavings to keep the short zinc from packing. The rest of the zinc is fluxed off during the melting of the precipitate. About once every three months enough short zinc accumulates to pay to cut it down with acid, although rarely is there over 600 lb. of short zinc to be cut down in this manner.

Some trouble is experienced with the precipitation, as at times a deposit made up of ferrocyanide of zinc and calcium, brown hydrated oxide of manganese and aluminum hydroxide coats the zinc, rendering it ineffective on the solution. The only thing to do when this occurs is to clean the boxes frequently until conditions can be righted again. Often the solution going to the precipitation boxes contains as high as 0.025 per cent. of copper in solution, which also gives trouble. Cleanups are made four times a month. It takes about 24 hours for six men to clean the boxes, about 38 hours to dry the precipitate, this being carried on simultaneously with the cleaning, and from 36 to 40 hours to melt the bullion. About 10.6 tons avoirdupois, of bullion per month is averaged, which is 11.71 fine in gold and 955.82 fine in silver. The precipitate as it comes from the boxes assays about 650 fine in gold and silver. It is the large amount of this bullion and precipitate that has to be handled per ton of ore treated, which makes the expense of refining compared with that at the gold cyanide plants appear so high.

All Combustible Rubbish Burned

The precipitate is dried in muffle furnaces heated with old wood and slack coke that cannot be burned in the melting furnaces. These muffles are also used to burn all the old belting, wedges, launders, waste, in short, everything combustible from around the mill that has come in contact with the cyanide solution. From this refuse in three months, about 3½ tons of ashes accumulate, assaying about 1.26 oz. gold per ton and 52.7 oz. per ton in silver. Melting is done in Faber de Faur tilting furnaces which are fired with coke. The slag, after being crushed in a jaw crusher and ground in an Engelbach grinder, is concentrated on a jig to remove shot metal, while the tails from the jig are settled for shipment to a smeltery. Because of the large quantity of precipitate to be refined each month, the superintendent, A. R. Parsons, is experimenting with an oil-fired reverberatory. He will try taking the precipitates direct from the press, and do the drying and refining in one operation in this small furnace.

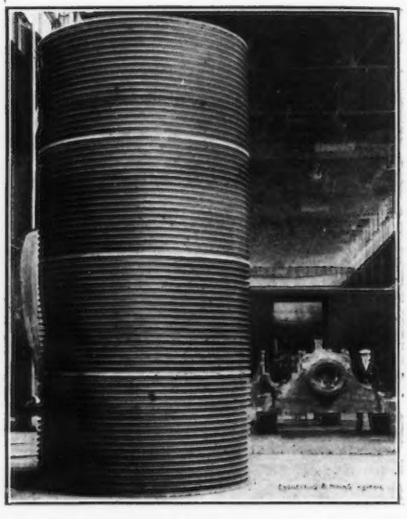
Chemicals and Labor Required

The consumption of chemicals for the fiscal year ended Feb. 28, 1911, has averaged per ton of ore milled, as follows: Cyanide, 3.18 lb.; lime, 8.64 lb.; zinc, 1.76 lb.; lead acetate, 0.473 lb. The extraction has been a little over 90 per cent. of the silver and a little under 90 of the gold, for one of the peculiarities of this ore is that at the end of the treatment the gold dissolves more slowly than the silver. In operating the plant a force of 85 men is used, as there is no mine at hand with which to share expenses such as general mechanics, electricians and office force. The actual crew in the mill on operation and ordinary repairs is 51 men for three shifts, including the foremen. There are six battery men, four crusher men, two distributer men, two excavator men, one sand-plant helper, three Butters filter men, four men on filter repairs, three Huntington mill men, three oilers, three refiners, one extra man in refinery on melting days, three solution men, three solution helpers, three concentrators, four repair men, three assayers, one foreman and two shift bosses.

The actual cost of milling during the year was $2.734 per ton of ore crushed for direct cost, while indirect costs brought up the expense of milling to $2.94 per ton. The items which make up the direct cost of milling are: Labor, $0.81; supplies, $1.46; power, $0.46 per ton of ore milled. The individual cost items are: Crushing, $0.117; stamping, $0.330; Huntington grinding, $0.169; concentrating, $0.134; elevating and separating, $0.089; conveying and discharging sand, $0.144; leaching sand, $0.549; agitating slimes, $0.471; filtering and discharging slimes, $0.136; precipitation, $0.216; assaying, $0.039; refining, $0.121; storehouse, $0.034; stables, $0.004; superintendence, $0.047; general plant work, $0.033; general expense, $0.006; steam heating, $0.085; water service, $0.006, making a total of $2.734 per ton of ore crushed. In explanation of the low cost of heating, it should be said that the steam is kept on only two shifts. The wages paid are: Battery men, mill and table men, $4.50 per eight-hour shift; electricians, $6; carpenters, $5.50; machinists, $5.50; helpers, $4.50; blacksmith, $5.50; blacksmiths' and carpenters' helpers, $4.50; solution men, $4.50; solution helpers, $4; head refinery men, $5.75; helpers, $4.50, and laborers, $4. The low cost with these labor charges and high cost of supplies in the Tonopah district show what can be done by attention to minute details.

A Large Rope Sheave

The accompanying illustration is of a rope sheave, 8 ft. diameter and 16 ft. 10 in. in width of face. The bore is 24 in. and the total weight 66,750 lb. The sheave was made in four sections with heavy return flanges bolted together. The sheave was designed for 4000 h.p. at 187 r.p.m, and carries 72 wraps of 2-in. rope.



Large Rope Sheave and Bearing

In order to carry this weight, a hollow shaft was designed, 20 in. in the bearings, bossed to 24 in. with a 14-in. hole through the entire length of 28 ft. 6 in. That the weight of the flange coupling might be reduced, flanges were forged at each end of the shaft, 30 in. in diameter by 2½ in. thick, to correspond with the flange couplings of the driven shafts at each end. This finished shaft weighed 24,375 pounds.

To carry this enormous weight at the speed at which it was operated, a new design of bearing was used. These mammoth bearings weighed complete with the base plates, 10,600 lb. each. They have 56-in. bearing surface in length, are self-oiling, using two brass rings, 1½x¾ in., to insure perfect lubrication. The sheave and accessories were furnished by the Dodge Manufacturing Company, of Mishawaka, Ind., to the Pittsburg Plate Glass Company, at Forge City, Pennsylvania.

Coal Mining Department

The Important News Of Coal Mining: New Appliances, New Methods, New Fields, Colliery Engineering

Coke Production in Ohio

The coals of Ohio belong to the Appalachian province and most of the beds are correlated with those of Pennsylvania and West Virginia to the east and southeast. But although the bituminous and semi-bituminous coals of Pennsylvania and West Virginia include the best coking coals in the United States, and although those two States are the first and second in rank as coke producers, the coals seem to lose their coking qualities as the beds extend westward and a large part of the coke made in Ohio is made from coal brought from West Virginia to byproduct retort ovens at Hamilton, near Cincinnati, and at Cleveland. On the other hand, some of the coal mined in Ohio is a good blast-furnace fuel in the raw state and this obviates the necessity of coking. When used raw, however, this coal is usually mixed with coke.

Ohio ranks fourth among the States as a coal producer but only fourteenth in the manufacture of coke, and until 1905, when the first installation of byproduct ovens was put in operation, Ohio could lay claim to little importance as a producer of coke.

During 1910 the work of dismantling 80 Rothberg ovens by the Cleveland Furnace Company and constructing 49 Semet-Solvay ovens from the old material was completed and the new ovens contributed nearly 20 per cent. of the total output of the State. Nearly 40 per cent. of the total output of the State came from the Otto-Hoffman plant, at Hamilton. The 25 Rothberg ovens left standing at Cleveland were not in operation in 1910. The average yield of coal in coke in the retort ovens was 72 per cent. In the 322 beehive ovens that constituted the remainder of the coke-producing facilities of Ohio the yield of coal in coke was but 64 per cent.

The total production of coke in Ohio in 1910, according to the U. S. Geological Survey, was 282,315 short tons, valued at $911,987. In quantity this was, with the exception for that of 1906, the largest production in the history of the State. The value of the product in 1910 was exceeded in two earlier years, 1905 and 1906. Compared with 1909 the production in 1910 showed an increase of 59,604 short tons, or 26.8 per cent. in quantity, and of $228,832, or 33.5 per cent. in value. The average price per ton advanced from $3.07 in 1909 to $3.23 in 1910. As in Illinois, the higher value of the coke made in Ohio, as compared with that of the neighboring States of Pennsylvania and West Virginia, is due to the fact that a large part of the coal used comes from the West Virginia mines and the transportation charges have been borne by the coal, the coke being made at or near the points of consumption.

Electric Arcs and Coal Dust

In a bulletin written by George S. Rice and issued by the U. S. Bureau of Mines, the following interesting discussion appears:

That an electric arc or a glowing wire could ignite coal dust in the air was not thought possible a few years ago, but since then several mine explosions have been laid to these causes. Of course it must take a combination of unusual conditions to start an explosion in this way, but such a combination may happen now and then. All that is necessary is to have an arc from a grounding or an overcharged hot wire surrounded by a thick cloud of inflammable dust. If a trip of cars runs away on a dusty road and breaks the trolley or feed wires, the wrecking of the trip stirs up the air and raises dust, and if this dust is easily set on fire, the forming of an arc by the broken wires may start a flame. Laboratory experiments at Pittsburg have shown that a small white-hot wire can set fire to a cloud of dust.

Many people have believed that an open flame could not ignite floating coal dust unless a shock, as from a blownout shot, accompanied the flame. Yet floating coal dust has caught fire about bins and dusty tipples. Usually there has been little damage done because the dust was not confined, but a bad explosion in the coal-grinding room of a cement plant in New Jersey is believed to have started from the flame of an open lamp. In mines, because the space is confined in rooms and entries, there is much greater chance of the burning dust causing an explosive wave. This possibility was shown in a recent coal-mine explosion that started near the mouth of a dusty drift. This drift was an intake, so the air could not have contained any gas. A trip of cars jumped the track and knocked out some timbers, thus making a dense dust cloud that was probably fired by the flame of a trip-rider's lamp. The explosion traveled a long distance into the mine and gained strength as it traveled.

An incipient dust explosion, started by the flame of an open lamp, was seen at a mine in Yorkshire, England. The dust that ignited was raised by a passing trip of cars. The flame followed the trip some distance and then ran back.

Baths for Miners

The report of the Miners' Federation of Great Britain on the question of compulsory washing at collieries has just been issued. The report calls attention to the clause in the new Mines bill, which requires that the management of each colliery shall provide suitable accommodations and facilities for taking baths and drying clothes; it is also provided that such accommodation shall be made obligatory on persons employed underground, and that each person shall be liable to contribute 2c. per week.

The objections cited in the Federation report may be set out as follows: (1) The compulsory nature of the act; (2) that men and boys would be liable to catch colds through washing at the mine; (3) that sufficient accommodation should be provided in the homes of the miners to permit of thorough bathing being carried out there; (4) that it would take some time to wash and change clothing at the mine, and that it would keep the miners an additional time away from home; (5) that washing in public is strongly resented by British workmen because of their innate modesty.

The advocates of the act providing compulsory baths answer these objections by stating, that all mining legislation in the interests of the general welfare of the whole body is compulsory; that under the present system, miners traveling to their homes in wet clothing are more liable to catch colds than if they changed at the mine; that if miners are provided with better housing, that is all the more reason why the dirt of the mine should be left at the pit-head. To the objection of time lost, it is pointed out that the bathing time at the pit-head would be less than at home, and as to privacy, it is stated that the accommodation must be "sufficient and suitable."

Some foremen persist in telling their miners that equally good results can be obtained when holes are fired without tamping. Such misinformation is particularly dangerous to the men working underground. The only time when tamping can be dispensed with is in dipping holes that will fill up with water.

Ventilation at the Leyden Mine

By G. C. McFarlane *

The results of experiments in improving the ventilation; also including a determination of the value of the frictional coefficient. Attention is called to many inaccurate statements on friction losses.

*Mining engineer, 503 Gas and Electric building, Denver, Colo.

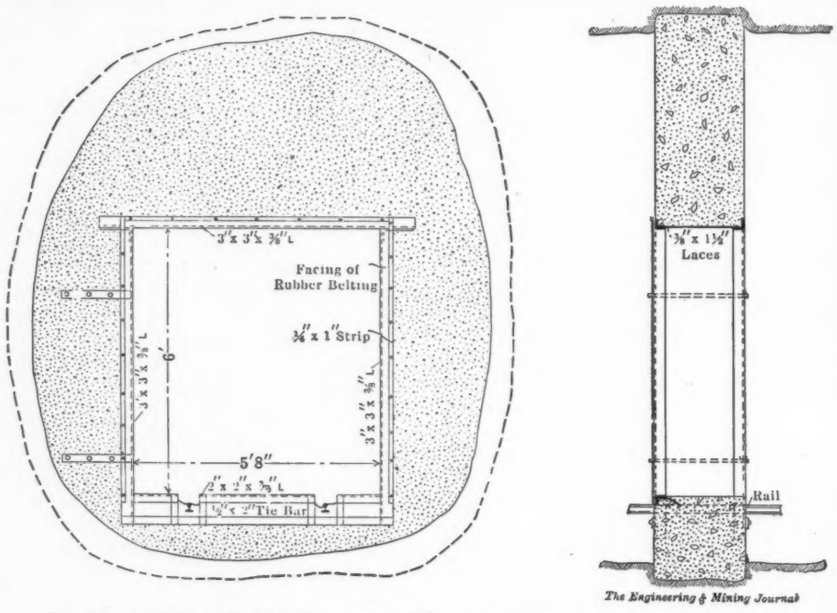
When the workings of a coal mine are extended to cover 400 to 500 acres, it is often a difficult problem to convey a good volume of air to the working faces, especially if the top is bad and the roof pressure heavy. Heavy roof pressure precludes the use of overcasts unless they are built exceptionally strong and massive; also with bad top the return airways are frequently more or less clogged with falls.

Aside from clogged airways the principal difficulty in carrying a good current of air into the remote workings is the leakage in the stoppings and doors. In the life of most coal mines, there comes a time when the air gets bad, it then becomes a question of cleaning up and retimbering the entries and putting in new and better stoppings and doors or putting in a new and larger fan. It is often a question just how far it is advisable to go in making doors and stoppings airtight, as the conventional practice is to use at most double inch brattices in the entry breakthroughs, and plain wooden doors on the haulways and transfers; it might be considered that renewing and repairing these and then increasing the fan power to force in the required quantity of air would be the proper solution.

Improving the Ventilation

A recent example in improving the ventilation of a coal mine has indicated to me that it is good policy to build more expensive and efficient stoppings and doors than those in common use. At the Leyden mine near Denver, the seam of lignite is 9 ft. thick and is reached by two 700-ft. shafts. The mine is worked panel system, two or three feet of coal being left for a roof in many places. It has been operated since 1903, and has produced about 1,500,000 tons of coal. About a year ago careful tests showed that although the doors and stoppings were put in in conformity to standard mine practice, and were kept in fairly good repair, less than 30 per cent. of the air coming in to the mine reached the working places, in fact nearly a third of the air short circuited through two or three doors around the bottom into the upcast. Of the air passing into the south side, 65 per cent. short circuited through 52 stoppings and six doors.

A new fan of the latest type and of double the capacity of the old fan, speeded to pull 2 in. of water-gage as against 1.3 in. for the old fan, only increased the air circulation at the working faces about 20 per cent. The next step was to replace six of the doors near the shaft bottom with steel doors hung from concrete settings of the style shown in the accompanying illustration. The frame consists of 3x3-in. angles on either side of the concrete wall which is 2 ft. thick. The opposite frames are held together by light lacing bars and the frame facing the door is covered by rubber belting held in place by strips of quarter by inch iron. The threshold is 2 in. higher than the top of the rails and faced on the side next the door by a 2-in. angle with anchors to hold it solid. It is, of course, channeled to allow the car wheels sufficient clearance. The doors are made of No. 10 plate reinforced by 2-in. angles around the edges and both diagonals; the door laps one and three-quarter inches on the frame. The cost of a door and setting of the size shown in the sketch is $18 for the frame, $31 for the door and hinges, and $62 for the concrete setting containing about 8 yd., a total of $111.



Sketch of Steel Door Hung from Concrete Settings and Used Near the Shaft Bottom

As an illustration of the amount of air that can leak through a wooden door in apparent good order, the first door on the main north entry showed a leakage of 15,000 cu.ft. per min.; the entry being at this point 18 ft. high and 12 ft. wide. The steel door and concrete setting that replaced it showed a leakage of only 700 ft. per minute and all this passed through slots for the wheel flanges, and the two haulage ropes, aggregating 22 in. in area. The saving in air leakage brought about by six steel doors costing $750 was 28,000 cu.ft. per minute.

The Stoppings Were Replaced

A great many of the board stoppings along the main and butt entries were replaced by more permanent ones. In the crosscuts between entries that showed evidence of squeezing, log stoppings were built. These were made of logs 3 ft. long 6 to 8 in. in diameter, laid in puddled clay. I find that it is a good idea to mix in some quicklime with the clay, this prevents it from shrinking as it dries out. The cost of these stoppings is 40c. per square foot of sectional area of the breakthrough. In damp places, or in places affected by squeeze, these stoppings become very tight, otherwise they have to be wedged or plastered over after a few months unless laid up in lime clay mortar.

The concrete stoppings were built 8 in. thick and cost 53c. per square foot of sectional area of the breakthrough; they are almost absolutely airtight. The labor item on this class of concrete work is high. A channel 4 in. deep is cut into the walls of the opening, which serves to hold the ends of the form boards and to securely anchor the concrete in the opening. Labor expense averages the work of

one man a day and half for each cubic yard of concrete. As to whether it pays to put in stoppings and doors of this character may be indicated from the following: In this particular mine there are in the main and butt entries 250 breakthroughs having a total sectional area of 12,000 sq.ft., the difference in cost of 18 in. concrete stoppings and double-board brattices for the whole mine would be less than $5000. The saving in fuel for the fan entailed by the improved air circulation amounts to between three and four tons of coal per day, and more air reaches the working faces than when a much higher water gage was carried under the old conditions.

Usually in installing a new fan the size of the fan receives little consideration other than to order one a little larger than the old one. Now for nearly every piece of machinery around a mine, it is good policy to have the machine a little larger than the requirements, but a fan should be neither larger nor smaller than the proper size as there will be a waste of power if it is too large, and a proportionately larger waste if it is too small. For instance if the old fan shows the mine airways will conduct 100,000 cu.ft. of air with a 2-in. water-gage, it is not likely the mine resistance will ever be much less and will in fact slowly increase as the workings are driven ahead. Such being the case, the proper size fan would be one which the makers guaranteed to deliver 100,000 cu.ft. at a 2-in. water-gage. If a fan having a capacity of 150,000 feet at a 2-in. water-gage were chosen, it would only draw 100,000 cu.ft. through the mine, and would require almost as much power to drive it as if it was pulling its rated capacity.

Formulas For Mine Resistance

In the formulas for determining mine resistance, $Pa = ksv$, when p, a and s equal respectively the pressure, area, and rubbing surface in square feet, and v the velocity in feet per minute; there is a wide divergence in the value assigned to the constant k by different authorities, the values ranging from 0.000000024 down to 0.0000000018, with a prominent American authority favoring the former figure. At the Leyden mine a careful anemometer survey of the shafts and air courses gave a value to k of 0.000000004, the density of the air being practically 5/6 of its density at sea level.

In nearly all handbooks on the loss of pressure in air pipes caused by friction, the statement is made that the loss in pressure is independent of the air pressure. This statement nearly always accompanies the tables of frictional air losses given in manufacturers' catalogs. This statement has often impressed me as being fallacious. According to these tables the formula $pa = ksv$ gives a value of 0.000000011 for the constant k, therefore if we consider that air friction is independent of the pressure of air, it would appear as if a smooth iron conduit offers two and a half times as much resistance per unit of surface as a mine entry, and this is preposterous. There is no question but what the tables are accurate as far as compressed air at 70 to 90 lb. pressure is concerned, for I have noticed in mines that the fall of pressure in the air lines as shown by gages was roughly the same as had been previously calculated from these tables.

If we consider that frictional losses are dependent of the density of the fluid, and assume that the tables on loss of air pressure in pipes were determined on air at 75 lb. gage pressure, then as densities vary as the absolute pressures, in this case as 12 to 90, the mine air at Leyden being 7½ times as light as the compressed air we would have a frictional coefficient on a smooth iron surface of 0.000000011 divided by 7.5 or 0.0000000015, as against 0.00000004 on the walls of a mine entry; this is practically the same difference as textbooks on hydraulics give for the flow of water in smooth iron pipes and when flowing in creeks and rivers over beds of gravel and stones.

In looking over tables giving the loss of pressure in air and water pipes, I find that the losses given for air are to the losses given for water as the density of air at 75 lb. gage pressure is to the density of water, that is, as 1 to 140.

Are Permitted Explosives Flameless?

Special Correspondence

For some time after the introduction of "permitted" explosives in British mining practice, the common view was held by mining men that such explosives were flameless. Experiences recited on April 2, 1911, at a meeting of the North Staffordshire Institute of Mining and Mechanical Engineers were brought before the House of Commons three days later. In view of the efforts of the U. S. Bureau of Mines to establish "permissible" explosives in American mines, an account of the proceedings may be of special interest.

It was pointed out that the Altofts experiments were being taken in hand by the British government and the hope was expressed that in a short time they would have information which would enable them to take effective steps to prevent those explosions that devastated a mine from end to end. It is proposed to carry out experiments on a larger scale than hitherto done, somewhere on the sea coast. What this may mean may be partly realized when the statement of W. E. Garforth is recalled, that at Altofts, windows had been broken 12 miles away by one of the explosions of coal dust.

Many members present testified that matches have been found in the mines within the last 12 months, and one of the witnesses said he would like to see altered the present practice in Great Britain of prosecuting and firing lads in whose possession matches were found in the mine. He does not think matches are taken down a mine intentionally, but at present if a man or boy finds any in his clothes, his first thought is that if detected he will be prosecuted. There is nothing easier than to hide them on a girder or a bar or in a pack, thereby endangering all the lives in a pit. Recently and for some time back, there have been found in almost every mine matches placed on girders or thrown on the gangway. The view of this witness was that if any person on finding such dangerous things in his possession knew that if he gave them up he would not be prosecuted or fined, it would be conducive to safety generally.

The Question of Coal Dust

A. M. Henshaw wanted to know if coal dust could not be prevented and removed; also what is to be done to neutralize it? Only one-tenth of an ounce of coal dust per cubic foot of air space is sufficient to carry on an explosion, and therefore he did not think it possible to prevent a dangerous accumulation of coal dust. Further, while it can be removed so far as shoveling up and sweeping go, it cannot be removed to the extent of ridding the roads of such a small quantity as one-tenth of an ounce per cubic foot of air space. That quantity will exist on the side of the roadway, in the cracks and spaces between the stones and on all the surfaces of the timber in the road, and even a vacuum cleaner, specially designed for use in mines, has been proved to be useless.

The best means known to Mr. Henshaw is to inoculate the coal dust by mixing it with stone dust. It is not at all impracticable. The stone dust can be ground in a mortar mill and sprinkled on the roadways. In his opinion, frequent and heavy sprinkling with stone dust will make the coal dust of such a character that the flame of an explosion passing along a road will not be carried very far. In his own research, he had found that a mixture of 50 per cent. of stone dust was quite sufficient to stop the flame. That was proved at Courrières, Talk-o-th'-Hill and at Hulton (Lancashire). There the flame traveled certain roads, but not with force sufficient to smash the cars. The dust he examined contained from 45 to 55 per cent. ash. Before the flame had burned the dust, there would not have been so much ash as that, and this bears out his contention that anything like 50 per cent. of stone dust or 50 per cent. of ash in the dust, renders the dust more or less harmless. He, however, advises that from 70 to 80 per cent. be used.

Following this testimony the meeting discussed the problem of explosives, any one of which under favorable circumstances would start an explosion. Some of the explosions, it was stated, gave off visible flame, but these explosives were manufactured by powerful companies and it was a delicate matter to make any statements about them. As in the case of matches being found in mines, a show of hands was taken of those who have positive knowledge of a permitted explosive giving off flame, the result being that the majority of those present held up their hands. The proceedings of the Institute received additional dignity and importance by reason of the Home Secretary on April 6, having two questions submitted to him in the House of Commons by Stephen Walsh, M. P. The form the questions took and the reply of the Rt. Hon. Winston S. Churchill in his capacity of Home Secretary, admirably summarize the discussion, and as already stated may be valuable as evidence in America.

FLAMING OF PERMITTED EXPLOSIONS

Mr. Walsh's questions, as submitted to Home Secretary, read:

(1) Whether he is aware that at the North Staffordshire Mining Institute, a statement was made by F. H. Wynne, His Majesty's inspector of mines, that he doubted whether there was an explosive on the permitted list which would not, under certain circumstances, cause an explosion in the presence of gas, without coal dust, or in the presence of coal dust, without gas; and to the statement made by A. M. Henshaw, at the same meeting, that two permitted explosives had given off visible flame, and that in one case of a permitted explosive largely used, the coal was ignited; and whether, in view of these statements on matters so gravely affecting the life and property of all connected with coal mining, he will cause full inquiry to be made into the truth of the above statements at an early date.

(2) Whether his attention had been called to the fact that J. T. Stobbs, instructor in charge of the Stoke-on-Trent Mining School had stated that his pupils had assisted him in keeping a record of cases where flame had been caused by permitted explosives of the highest repute, and that the record ran into teens; whether he will at as early a date as possible ask to be supplied with the list of permitted explosives that are said to have failed in the manner indicated; and whether he is prepared to suspend the use of such permitted explosives as may be mentioned in such list until the truth or otherwise of the statement is established.

In his reply Mr. Churchill said:

"I was not aware of the particular statements referred to in the questions, but I am advised that it is a fact well established and generally known that all explosives emit flame on detonation, but the flame is not necessarily such as will ignite gas or dust. That depends on the temperature and duration of the flame. It has never been contended, however, that it can be said of the explosives which pass the Home Office test, or of any known explosives, that in no circumstances can they cause an ignition, and this has been repeatedly pointed out in official documents emanating from the Home Office. Their use is allowed only under stringent conditions as to the mode of firing and the absence of gas. The question of instituting a new and severer test is now under consideration, and it will, I hope, be brought into force in the course of this year. As regards the case in which coal is said to have been ignited, I am advised that this was, no doubt, due to one of the cartridges in the shot igniting and not exploding. The fire was easily extinguished."

Prevention of Mine Explosions

In a recent circular issued by the Kansas State Geological Survey, Erasmus Haworth, after a discussion of the causes leading up to the disastrous explosion at Mineral, Kan., March 18, sums up as follows:

(1). I recommend that no one ever assume that any coal mine is free from firedamp or natural gas. It is a most dangerous assumption. A mine may have so small an amount of firedamp in it that ordinary methods of ventilation will prevent its becoming dangerous while ventilation is kept up to a proper degree. Any shot at any time in any mine is liable to break into a gas reservoir and permit a dangerous amount of gas to rush into a mine. This has occurred over and over again in Kansas and elsewhere. But it is vastly more dangerous to assume that an abandoned mine, or an abandoned part of a mine being operated, will remain free from gas. Don't make such an assumption.

(2). I recommend that all mine operators at once make provisions for relieving the air pressure in all abandoned mines which are at all likely to be broken into by development processes in adjacent mines. This can be done easily and cheaply by drilling one or more holes from the surface into the part of the abandoned mine where the roof is the highest. Suppose, for example, that a 6-in. hole had been drilled from the surface into the abandoned part of mine No. 7 at Mineral. Then accumulation of water in the mine could not have caused this extra pressure in the air left in the abandoned mine, and, as a result, even though the gas was there, it would not have rushed through into mine No. 16 the way it did, and therefore the explosions could not have occurred. Care should be taken to drill these vent holes so that they will tap the abandoned mine at places where the roof is the highest, and a large drill bit should be used, so as to make a large hole, not less than 6 in., and larger if possible. The drill hole should be cased well so it will remain open permanently.

Now, as natural gas is lighter than air, the gas which is likely to accumulate in all abandoned mines will escape first through the drill hole, and later such air will escape as is necessary to prevent an excess pressure should water enter the mine. This is a simple remedy, and I fear on account of its simplicity will not appeal to operators and miners as it should. But I consider it as important, for human life and human property are valuable.

(3). All operators and all miners should require a drill hole to be kept in advance of development wherever development approaches an abandoned mine. This has been enacted into law in many States, on account of the well known fact that gases do accumulate in abandoned mines. Had it been obeyed in this case, enough gas would have rushed through the little drill hole to give an alarm, and more than likely the explosions would not have occurred.

The Burns Anthracite, Mine, Alberta

ALEXANDER SHARP*

The Burns anthracite-coal property consists of 15,360 acres of Crown-granted land, beside an area leased from the Dominion Government. The nearest railway towns are Calgary and Okotoks, each distant about 45 miles from the property. The coal measures belong to the Lower Cretaceous period, Kootenay series. The formation comprises about 4000 ft. of sandstone, dark shale, conglomerates and, near the base, some clay and ironstone. At intervals in the strata occur the coal seams and coaly shales, the whole resting on Carboniferous limestone. The area is 11 miles long and from one mile to three miles broad. The coal measures lie in a long, narrow, synclinal trough; strike N. 42 deg. W., and dipping to westward at an angle varying from 52 to 80 deg. The southeastern outcrops are at elevations from 300 to 2000 ft. above the valley of Sheep creek, but toward the north, at Burns creek, the coal comes down to the level of the valley and has every indication of going deeper. Ten or 12 seams of coal have been exposed and traced, by drifts and opencuts, about five miles. These exposures show fully 100 ft. of coal in the measures. Fifteen samples, taken from seams ranging from 4 ft. 6 in. to 20 ft. in thickness, gave analyses varying between the following percentages:

NOTE—Abstract of paper read before the Western Branch of the Canadian Mining Institute, May 18, 1911.

*Mining engineer, Orient, Wash.

Moisture, 1 and 2.10 per cent.; fixed carbon, 70.65 and 82.25; ash, 3.5 and .17; sulphur, 0 and 1; volatile, 9.6 and 13.43 per cent.; B.t.u., 14.877 (one sample).

Complete analyses of two samples from a 7-ft. seam on Rickerts creek are as follows:

	No. 1	No. 2
Water	0.98	1.02
Carbon	84.77	87.24
Ash	5.42	5.92
Sulphur	0.18	0.18
Hydrogen	3.63	2.92
Oxygen and nitrogen	4.48	3.24
Coke	90.64	92.81

The topography of the country is favorable to economical mining. Some of the seams come down to the level of the valley so that they can be reached easily by tunnels at the valley floor. Any of the seams can be drifted on from either side of the several creeks that cut the formation. Thus a chain of collieries can be operated along the valley. Power can be generated from water-power of the creeks. The seams are being prospected at different horizons so that the nature of the roof and floor texture may be ascertained before any permanent opening is made. The difference in elevation between the coal property and Okotoks is about 2150 ft., or approximately 48 ft. to the mile.

Rendering Coal Dust Inexplosive

SPECIAL CORRESPONDENCE

In order to see how the inflammable nature of coal dust may be neutralized by a regular and plentiful admixture of stone dust, the members of the Manchester Geological and Mining Society at the special invitation of W. E. Garforth, managing director of Pope & Pearsons collieries at Altofts in Yorkshire, recently visited the Silkstone pit.

How to destroy the explosive character of coal dust has been the object of long and laborious research at the Altofts collieries, and at the three mines forming the group, Mr. Garforth made stone-dust zones by mixing fourteen parts of stone dust to one of coal dust. The stone is ground at the bottom of the pit, boys being employed to scatter the stone powder on the sides and roofs of the haulageways wherever coal dust was found. The yearly cost of providing this safeguard would appear to be a trifling matter, for, whereas the amount of coal raised approximates 600,000 long tons per annum, and the total wages bill at the three mines is in the neighborhood of $620,000, the proportionate outlay for distributing the stone dust is only $1500. The total length dusted in the three seams is 4552 yd., and the work is being carried out thoroughly and systematically, and yet an examination of the record shows that the cost is well within one-fourth of a cent per ton of output.

Mr. Garforth explained his purpose to the members present, and also the reason why he had taken up this matter so zealously. The circumstances are, that there was an explosion at Altofts in 1886 and several men were killed. The evidence laid before the jury at the inquest clearly pointed to the explosion being due to coal dust and not in the least degree to gas. At a later date in 1891, he expressed the view before the Royal Commission that owing to the numerous evidences of stone dust putting out the flames, stone dust would prove more efficacious in extinguishing the flame in mines than water.

Time was passing but the controversy remained unsettled; one set of mining men said coal dust was not explosive and another said that it was. Thereupon said Mr. Garforth, the Mining Association of Great Britain arranged for experiments to be made at Altofts. These experiments were exhaustive, and in the end they settled the question as to the explosiveness of coal dust after 30 years of controversy. The Mining Association spent about $65,000 in this task and now the British Government has taken the matter in hand. The association has given all their appliances, and the government proposes to carry on the experiments at some seaside place where they will not cause the annoyance that they do in populous districts like Altofts.

MICROSCOPIC EXAMINATIONS OF COAL DUST

At a later meeting of the society, James Lomasc explained the possibilities of determining the inflammable qualities of coal dust by means of microscopic examinations. The microscope is employed in determining whether there is to be found in coal any constituents which might serve as a guide to the inflammable nature of the dust derived from it. For the purposes of his paper, seams were tested in the pits of the Hulton Colliery Company. The coals examined with some exceptions, were purely humic coals, composed of the droppings of the trees and plants in the form of spores of fruits, leaves, twigs and sometimes flattened stems, etc.

In the hardest and brightest coals the materials seem to have been reduced to a more or less pulpy state before carbonization. In coal there is a great amount of resinous matter, which in many cases is easily converted into most inflammable dust. The spores contained in the coal have not, after many ages, lost their explosive energy. The detection of these spores by the aid of the microscope gives some clue as to the inflammable properties of the coal, and a systematic microscopic inspection both of coal and dust will be of benefit in many directions.

The problem of coal dust has also been dealt with by Prof. Harold B. Dixon before the Chemical Society in London. The presence of finely divided coal dust in the workings and roadways of a mine has long been known to add to the danger of firedamp explosions, and more recently it has been recognized that fine coal dust suspended in the air forms an explosive mixture through which flame is propagated with the rapidity and violence characteristic of true explosives. Nearly 20 years ago, Professor Dixon urged the necessity of making trials on a working scale to determine the nature of the waves set up in a dust explosion. During the last two years at Liévin in France and Altofts in England valuable information has been gained as to the power of flame to penetrate through a dustless zone, to dust-laden air beyond, and as to the damping effect of stone dust on the ignition of coal dust by a blownout shot.

THE ALTOFTS EXPERIMENTS

Referring more particularly to the Altofts experiments, Professor Dixon said, an iron gallery, 600 ft. long and 73 ft. in diameter, was constructed of cylindrical boilers bolted together. Inside, a tram line on a concrete floor with props and cross timbers placed at 9-ft. intervals, made a traveling road, comparable with the main haulage road of a mine. Shelves fastened to the sides provided ledges for holding dust, and the flame of a blownout shot was reproduced by firing a stemmed gunpowder charge from a cannon. Just before firing, a current of air was drawn into the main gallery by a fan placed at the end of a return gallery. By this means a pure coal-dust explosion, extending over several hundred square feet, was obtained, and the propagation of the flame and pressure studied. So far as the tests have extended, Professor Dixon says the propagation of the coal-dust flame appears to be similar to that of the flame in mixtures of coal gas and air or of firedamp and air.

One curious parallelism between the initiation of a dust and of a gas explosion has been noticed; when the dust was ignited in the middle of the empty gallery, without obstructions such as the props afford, the explosion was slow and feeble. The burning of a gaseous mixture in a small tube was similarly slow and nonluminous until the flame reached one end of the tube, or an obstruction from which a wave can be reflected back. It has been shown in the experimental gallery that an explosion was propagated through a cloud of charcoal dust in air. The Altofts experiments, Professor Dixon added, have given most valuable information and the work should be completed on the lines so successfully begun.

In preparing an explosive charge underground, a miner should always place his lamp 5 or 6 ft. away from the powder box and on the side where the air current is traveling from the box.

PERSONAL

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

Prof. A. L. Walker sailed for Europe on June 10. He expects to return in August.

James E. Roderick has been reappointed chief of the Bureau of Mines of Pennsylvania for another term.

Thomas H. Stretton, mining engineer of La Blanca y Anexas Company, Pachuca, Mexico, has gone to England on a vacation.

Alexander Leggat sailed from Seattle, June 8, on his way to examine some copper properties west of Cook Inlet, Alaska.

C. W. Geddes, late consulting engineer of the Foley-O'Brian mine. Porcupine, Ont., succeeds Mowry Bates as manager.

S. E. Bretherton, of San Francisco, has been engaged by the Adaven Mining and Smelting Company, of Nevada, as consulting engineer.

Howard Poillon has been appointed manager of the mines and acid treatment plant of the Vanadium Mines Company at Cutter, New Mexico.

Harvey H. Brown succeeds the late Alexander E. Brown as president and general manager of the Brown Hoisting Machinery Company, Cleveland, Ohio.

Louis D. Huntoon has gone to the Porcupine district, Ontario, and expects to remain there about two months. On his return he will open an office in New York.

G. T. Hansen, for several years metallurgical engineer for the Allis-Chalmers Company, has been appointed manager of the Salt Lake City office of the company.

Jay P. Graves, of Spokane, Wash., general manager of the Granby Company, and George W. Wooster, of Grand Forks, B. C., treasurer, were in New York recently.

Dr. Robert H. Richards, head of the department of mining and metallurgy at the Massachusetts Institute of Technology, has been elected an honorary member of the American Institute of Mining Engineers.

Paul W. Gaebelein, consulting engineer for the Colorado Metals Extraction Company, Denver, Colo., is in New York in the interests of the company. On his return to Denver, he will stop at Chicago, St. Louis and Kansas City.

Geo. S. Rice, mining engineer, on the staff of the U. S. Bureau of Mines, intends to sail for Europe on June 17, with a small party of engineers who are being sent by operators in the anthracite coalfield and in the soft coalfield, to study European practice.

Richard E. Williams, superintendent of the Waihi mine, New Zealand, has lately been visiting Cornwall on a holiday. He is planning to return on Aug. 31 to New Zealand for a further engagement of two years, having already served the Waihi company for nine years.

Dr. Rossiter W. Raymond, a former editor of THE ENGINEERING AND MINING JOURNAL, for many years secretary of the American Institute of Mining Engineers, and now secretary emeritus of the Institute, has been elected an honorary member of the Institute.

J. E. Searles and Leonard Cahoon have organized the Searles-Cahoon Company, engineers and constructors, with office at 524 Newhouse building, Salt Lake City, Utah. Both have been for several years connected with the United States Smelting, Refining and Mining Company.

Lewis T. Wright has resigned the management of the Mountain Copper Company and will now make his headquarters in London. In the management of the Mountain Copper Company he has been succeeded by William S. Ketts, who has heretofore been Mr. Wright's chief assistant.

J. E. McAllister, late general manager of the British Columbia Copper Company, who has come to New York to engage in consulting engineering, has taken quarters with Benjamin B. Lawrence at 60 Wall street. Mr. McAllister achieved an enviable reputation in his management of the British Columbia Copper Company.

W. J. Hall, of Wallace, Idaho, chief accountant for the Federal Mining and Smelting Company, has been promoted to assistant general manager. Rush J. White has been given the office of superintendent of mines. He has been chief engineer of the company for a number of years. W. Clayton Miller, of Spokane, is general manager for the company.

OBITUARY

John Holms, the oldest miner in Indiana, died at his home in Linton, May 27. Mr. Holms was born in Nottingham, England, in 1826. He came to this country in 1837 and had worked in the mines nearly 70 years.

J. O. Buckley died at Black Hawk, Wis., June 4, aged 52 years. He was engaged for a number of years in developing the Sauk County iron district of Wisconsin, and was president of the Queen Consolidated Mines Company.

George W. E. Dorsey died at Salt Lake City, Utah, June 10, aged 68 years. Some years ago he served three terms in Congress from Nebraska, but later went to Utah, where he was actively engaged in mining. He was an officer of the American Mining Congress.

E. Curtin, recently of Goldfield, Nev., died at Madison, Wis., May 22. He was well known throughout the West, and at one time was superintendent of the Portland mine, at Cripple Creek. Later he was superintendent of the Mazuma Hills mine and of the Broken Hills mine at Helena. He went to Nevada during the Goldfield excitement and was interested in mining there for some time.

Hector M. Bowen, of Los Angeles, Cal., owning mining properties near Kingman, Ariz., was killed by a premature blast at one of his mines on June 3. Mr. Bowen had gone to the mine to supervise and direct the work for a few weeks, and was particularly interested in the uncovering of a new orebody. He was well known about Los Angeles as a sportsman and successful mining man. He went to California from London several years ago. He was 40 years old.

John J. Spearman died at Sharon, Penn., May 21, aged 86 years. He was born at McKee's gap, Penn., and began work at the old Hopewell iron mine when 14 years old. He worked at Sarah furnace and Maria forge in Huntington county, and in 1847 was made assistant manager of Sharon furnace. In 1852, he bought Mazeppa furnace on his own account and operated it until 1859, when he accepted the position of manager of Sharpsville furnace. In 1862 Mr. Spearman entered the employ of James Wood & Sons, Wheatland, Penn., and was admitted to partnership during the following year. He sold his interest out in 1870 and in the fail of 1871 organized the Spearman Iron Company. This plant was sold to W. P. Snyder, Pittsburg, in 1901. He was the oldest ironmaster in the country, and was one of the first to use Lake Superior ores. Mr. Spearman's memory remained clear until the end and he was a perfect mine of information regarding the early days of the iron trade.

SOCIETIES and TECHNICAL SCHOOLS

Kentucky Institute of Mines—This association was organized at a meeting held at Lexington, Ky., recently, by officials of coal companies and others interested. The formation of the institute was due largely to the efforts of Chief Mine Inspector Norwood, who has long recognized the need of such an organization to promote the interests of both miner and operator. For convenience in handling the affairs of the institute, the State is divided into seven districts, with a vice-president in charge of each district, while the president and other officials will have jurisdiction over the whole State. The officers elected were: President, John B. Atkinson, Earlington; vice-presidents, J. D. Rogers, Dr. R. S. Collier, Hon. J. F. Bosworth, C. W. Taylor, W. H. Cunningham, B. R. Hutchcraft; secretary, Thomas J. Barr, Lexington; treasurer, M. L. Conley, Morgan county.

Editorial Correspondence

Reports from our own Representatives on Important Events from Many Important Mining Centers of the World

San Francisco

June 9—Electricity is rapidly and extensively replacing steam and direct waterpower in the operation of the mines of California. In some districts the advancement has been slow and gradual from the wood-fired boiler to the improved water wheel and the generation of steam by oil fuel. There has never been extensive use of coal fuel in the mines. When oil became an economic fuel for other industries, the cost of transportation in many mining districts precluded its extensive use, and where wood was plentiful and cheap the mines relied upon that resource, or adopted the waterwheel in such localities as assured a constant supply of water. But neither wood nor a local supply of water can always be depended upon in all the districts that are capable of large mineral production. When the large power plants entered the field and gave assurance of constant electrical supply, the mine operators were quick to see the solution of the power problem, and there has been steady advancement toward the complete adoption of electrical power for mines, mills and smelteries. Attention was particularly drawn to the improvement in motive power, as applied to the mines in the Mother Lode district on a recent Sunday, when all the mines employing electricity were closed, or partially closed, for 24 hours, pending some essential repairs at the power plant at Electra. The mines were notified and were so prepared for the interruption, which did not in any manner affect the economy of operation. Some of the properties not wholly dependent on electricity continued their usual Sunday operation. The South Eureka and the Bunker Hill have both discarded oil fuel and are wholly dependent on electricity. The Central Eureka is also dependent on electricity for both the mill and the hoist. The hoists at the Kennedy and the Zeila are operated by steam. It is usual at the Kennedy to employ the Sundays for repair work at the mill, so there was no interruption in the regular course. While the Zeila mill, which is driven by electricity, stood still for the day, there was no economic disadvantage, as the crushing power of the mill is greater than the capacity for ore extraction. The Argonaut mill employs electric power, but as the hoist is operated by water, there was no interruption in ore extraction. This mine will install a 150-h.p. electric motor for hoisting, and thus be in the same class with the South Eureka, Bunker Hill and Central Eureka. It is claimed that electricity has an economic advantage over steam power generated by oil fuel equal to the advantage of oil over wood fuel.

Denver

June 12—The "Grubstake fund" of the Denver Chamber of Commerce has now reached over $6000, and the desired total of $10,000 is expected to be reached.

Since 1896 the Colorado School of Mines has carefully prospected and mapped, and also analyzed, the ores of the vanadium-uranium field of southwestern Colorado, where foreign capital is now much in evidence, and is buying from the prospectors, who have been active in making new discoveries in the district. Bearing this in mind, the Leadville *Herald-Democrat* suggests that the Denver Chamber of Commerce "grubstake" the seniors of the Colorado School of Mines. It says: "Turn loose this trained and active corps of young and ambitious men in these hills. Let them have their kits of assay materials, their field equipment and other necessities. Give them some stimulus in the matter of reward for discovery, and if there are surface indications we believe that they will find something worth while. Who fathered the delusion that the prospector must be old? Why is that individual always depicted with a long white beard, and a general patriarchial appearance? When the prospector of the good old days was actually engaged in the great pioneer work he was a young, lusty, vigorous specimen of robust manhood."

Governor Shaffroth vetoed the mine-inspectors bill that passed the eighteenth General Assembly. The bill was drawn up after a long conference of practical and technical men, and passed the house in its original form. But it was so amended in the Senate that it bore no semblance to the original.

Butte

June 10—The production of the Butte district for May shows 21,700,000 lb. of copper turned out of the Anaconda smelteries, of which 15,500,000 lb. were produced by the Washoe smeltery, and 6,200,000 lb. by the plant at Great Falls. Two million pounds of this amount belongs to the North Butte company, and 750,000 lb. to the Tuolumne company. The East Butte company produced 1,000,000 lb., bringing the total production of the district up to 22,700,000 lb., exceeding the April production by 100,000 pounds.

On June 3, in the injunction and damage-suit proceedings of the Anaconda company against the Butte & Ballaklava company, a demurrer was argued before Judge McClerman, of Butte, by C. F. Kelly, chief council for the Anaconda company, and T. J. Walsh for the Butte & Ballaklava company, and taken under advisement. The Anaconda company sets forth as reason for bringing suit, that the vein in controversy apexes on two Anaconda claims, adjoining the Ballaklava property, and in the demurrer six different causes of action against the defendant company, for trespass on these claims, are pleaded. In his answer to the demurrer, Mr. Walsh pleads that they should be included in two counts only, claiming that the various causes of action were included in former actions.

Salt Lake City

June 10—Though Bingham is essentially a copper camp, lead ore occurs in different parts of the district, often forming the upper part of copper shoots, or in independent bodies along northwest fissuring. A body of lead ore of considerable importance, and one of the largest ever found here is being developed by the Utah Apex. This was encountered on the lower tunnel level about November or December 1910, and has been developed for 400 ft. in length, and up to 54 ft. in thickness. The orebody is a heavy sulphide replacing a bed of limestone, and has quartzite for the hanging wall. This is the reverse of the usual ore occurrence at Park City, Bingham, and elsewhere in the State where quartzite as a rule forms the footwall of the ore. The limestone in this instance is some distance above the main Weber or Ontario quartzite, and the hanging wall is a small band of quartzite interbedded in the limestone. The length of the body has not been determined, and it is being drifted on in two directions, both faces being still in ore. This is a mixture of galena and pyrite running low in silica, and carrying a large excess of iron. It is shipped as broken, without any sorting. The production at this time is about 150 tons daily, and some days 180 tons. It is expected that shipments will be steadily increased during the summer. The ore is being mined by the room-and-pillar system, modified to suit local conditions from the regular Lake Superior caving

system as used in the iron mines of the Gogebic range. Rooms or chambers are mined out about three sets wide, and are filled with broken ore, as the work proceeds. A pillar four sets in width is left between these chambers, and the filling and pillars are later drawn out, the latter requiring some shooting. This method differs from that used in the underground mining in the former Boston Consolidated, where little or no timber was used, but the amount of timber employed in the Apex is not excessive, and insures much greater safety for the men. The mining costs are low. This latest occurrence of shipping ore has changed the plan of resuming mill operations for the present, and the entire attention is being given to mining and developing the new resource. The width of the body has not been determined, but is thought to be in the neighborhood of 150 feet.

Duluth

June 12—A recent development in the case of the accident at the Norman open-pit mine Virginia several months ago, is of interest. The Oliver Iron Mining Company operates this pit, and the accident, which was caused by a slide of earth, loosened by an early thaw, resulted in the death of 14 men at work in the bottom of the pit. Of these 14 men, five were of Finnish nationality, seven Austrian, one Norwegian and one Polish. Of the total number, 12 were citizens of the United States. Under the laws of Minnesota, the minimum amount for which the company is liable, in case of death, was $5000 for each individual. Instead of the oft-recorded, long drawn-out legal entanglements which so frequently mark cases of this sort, the whole affair has been settled out of court and voluntarily by the Steel Corporation, of which the Oliver company is a subsidiary. In the cases of the 12 men who were citizens, the $5000 has been paid to the heirs of each one. The heirs of the two who were not citizens are now being settled with through the consuls of their respective countries. So far, merely the law has been complied with, with the possible exception of the two aliens. An act of charity and one which might well establish a precedent in accidents of this sort, occurred in the instance of one of the other twelve. The death of one of these men left seven children as orphans, ranging in age from 2 to 12 years. There were also left certain debts and incumbrances upon the home. While working for the Oliver company, the father had earned on an average from $50 to $55 per month. The Oliver company has paid off all debts on the home, leaving the $5000 clear. In addition, arrangements have been made whereby the company will pay $10 each month for each child, until each one of them reaches the age of 18 years. Such a policy is in striking contrast to the ordinary run of mining accidents and their usually soon-forgotten results.

Some idea of what the iron-mining industry on the Minnesota ranges means to the State of Minnesota, can be gained from the fact that on May 31, taxes on St. Louis county real estate to the amount of something over $2,000,000 were paid. The Oliver Mining Company alone paid in four checks aggregating $1,402,236. These amounts constitute only the tax for the realty holdings for the first half of the present year. The personal-property tax was paid earlier in the spring, and amounted to between $30,000 and $40,000. This does not mean that the total yearly taxes are double this amount, as certain taxes are payable in full in the first half of the year.

Houghton, Mich.

June 10—There is a considerable movement in the Lake Superior copper and iron countries in the direction of securing greater efficiency in underground practice. "Scientific management" and one-man drill practice are subjects that are engaging attention. The Calumet & Hecla, Copper Range and Quincy companies in the copper country; and the Republic Iron and Steel, Cleveland-Cliffs Iron Company, and the Munro Iron Mining Company in the iron country are working upon these ideas.

Spokane, Wash.

June 10—When the Washington Water Power Company completes its power plant at Long lake, 23 miles north of Spokane, where four turbines, with a maximum capacity of 90,000 h.p., will be installed, it will be in position to deliver electric power to any mining camp within 150 miles of Spokane. The plant, including the railroad from Spokane to Long lake, involves an expenditure of $4,000,000. More than $17,000,000 already has been invested in street railway, lighting and power systems in and near Spokane.

Practically all the power used in the mines and mills in the Cœur d'Alene district, 128 miles east of Spokane, is supplied by the Washington Water Power Company. Between 8000 and 10,000 h.p. is sent to that section every day, some of it from the Post Falls plant, some from Little Falls and some from the two plants in Spokane.

Porcupine

June 8—The steel on the Porcupine railroad has been laid as far as Golden City at the northern end of Porcupine lake. By June 15, it is stated, the road will have encircled the lake and have reached Lakeview townsite. From that point, cutting the right of way to the Hollinger is in progress, and construction will be pushed as fast as the grading can be done. The decision to continue the line as far as the Hollinger, came as a considerable surprise, and opens up a field for speculation as to what is to become the center of the Porcupine camp. Since the disastrous fire, from which the Hollinger suffered so much, the work of rebuilding has been progressing rapidly. The fires in the shaft have been entirely extinguished, and sufficient boiler power generated to pump out the mine, and start a compressor. The sawmill is being rebuilt, so that the burned buildings can be replaced. In the meantime the force of men has been reduced from 225 to forty.

Cobalt

June 11—Both the Kerr Lake and Crown Reserve mines have recently entered into an agreement with the Nova Scotia company, whereby this company will treat all their low-grade ore. The contract is for five years and the Nova Scotia will buy the ore outright; the price varying with the value of the ore and the price of silver. The Crown Reserve will send 100 tons and the Kerr Lake 75 tons per day, the ore to be transported over an aërial tramway. The present capacity of the mill is 100 tons per day, and this will be increased to 200 tons by the addition of 20 stamps and other machinery.

Toronto

June 12—The Canadian Government has passed an order-in-council, abolishing the royalty on gold extracted or obtained from quartz in Yukon territory. The order sets forth that it is desirable to give every possible encouragement to an industry which, up to the present, has developed so little that no royalty has actually been collected.

When the Canadian Parliament reassembles in July, Hon. William Templeman will introduce the new mining law, codifying and simplifying the existing regulations into a uniform act, applicable to all the mining lands under federal control. It is hoped to induce the various provinces, which have jurisdiction over their own mineral lands, to assimilate their mining laws to those which will be adopted by the Dominion.

A discovery of small diamonds in chromite about 40 miles from Sherbrooke, Quebec, is reported. The laboratory staff of the Canadian Geological Survey, at Ottawa, is endeavoring to discover a satisfactory commercial extraction of diamonds from the chromite in which they occur. Should the attempt be successful, it would lead to the development of a diamond industry and also stimulate the mining of chromite. R. A. A. Johnston, mineralogist of the survey, will, in a few weeks, leave for Germany, taking with him samples of the Canadian diamonds, and carry on further researches there.

The Mining News

Reports of New Enterprises. New Machinery. Installations. Development Work and Property Transfers. The Current History of Mining

Alaska

From the condition of the ice, it is probable that the Nome season will be late in opening. The ice is apparently solid for several miles from shore.

The Copper River & Northwestern announces that preliminary surveys will be started at once for an extension of the railroad of over 60 miles. This extension will take in the well known creeks of Nazina, Chittitu, Dan and others, on which several properties are being worked.

Chugach—Development is progressing on this property, and a number of tunnels are being driven. B. F. Millard, Valdez, is manager. The property is on Mineral creek.

Temple—Arrangements are being made to erect two tramways leading from this copper mine to the wharf. The company will be the next shipper of copper ore. Two crews are at work. S. A. Hemple, Landlock, is in charge.

Alaska-Calumet—Benjamin Daggett, of San Francisco, representing eastern interests, recently took an option on this property, about 20 miles from Bonanza, the present terminus of the Copper River & Northwestern. Men and engineers will be sent north at once to develop this mine.

Mineral Creek—Lumber has been shipped to this mine for the erection of buildings. The tunnel is in 500 ft. J. M. Lathrop, Valdez, is in charge.

Arizona

The Arizona Consolidated Smelting and Mining Company of Tucson is reported to have contracted with the Colorado Iron Works for a custom smelting plant to be erected near Tucson. The capacity of the plant is to be 300 tons per day and the cost about $100,000.

Cochise County

Great Western—This company, at Courtland, is building ore chutes and will ship to El Paso.

Commonwealth Extension—This new company, at Pearce, will develop a discovery made by J. J. Pearce, the finder of the Pearce mine.

Gila County

Old Dominion—The directors have increased the quarterly dividend from 25 to 50c. a share. Profits are reported to be $100,000 monthly and the cost of copper 8c. per lb. The ore reserves in the Gladiator at the United Globe end of the property are given as 400,000 tons of 5 per cent. copper ore.

Kelvin-Sultana—The company is offering a note issue of 1500 bonds $100 par 7 per cent. for the purpose of building a 1000-ton concentrator at the Diamond Joe shaft, Kelvin. George P. Baldwin, Monadnock Block, Chicago, is president.

Inspiration—The company has an option for the Cordova property adjoining at a price said to be $76,000.

Mohave County

Vaughan—This mine at Boundary Cone has been optioned to Paul A. Johns.

California

Amador County

Lincoln—The 1200-ft. west crosscut to cut under the ore channel in the 500-ft. west crosscut has advanced to 1000 ft. The orebody in the 800-ft. level has widened to 4 ft., and improved in character.

South Eureka—The present depth of the shaft is 2800 ft. Orebodies have been tapped on each of the nine levels. New orebodies have been disclosed in the last year by drifting northwest from the 2600-ft. level, and following the veins to the 2800-ft. It is claimed that the developments of the year indicate nearly 1,000,000 tons of ore, and that so far as mined and milled the values run from $4 to $6 per ton, and the working cost is about $2.63 per ton. The mill treats about 12,000 tons per month. Two hundred and twenty-five men are employed.

Butte County

The Drexel estate has built and put in commission a gold dredge on its lands on Butte creek, eight miles east of Chico.

Calaveras County

S. R. Fox and others indicted by the Federal grand jury for violation of the débris laws in allowing débris from hydraulic workings to enter the San Joaquin river and other streams, pleaded not guilty in the United States court at San Francisco June 2. Instructions from Washington insist upon vigorous prosecution of such cases.

Eldorado County

Grant—The 600-ft. tunnel is being cleaned preparatory to sinking on a vein of sulphide ore in this mine at Magra. If development warrants a mill will be installed. F. A. Moss is owner.

Lucy Ann—A close corporation of Sacramento men has bonded this property in Green valley, and will begin development by sinking on the vein. The property has been idle for 25 years. Newton Judson, superintendent.

Pacific—A 150-h.p. compressor is on the ground and will be immediately installed for drilling. It is intended to install also a Pelton wheel to take water from a 2000-ft. pipe line, for compressor power.

Mariposa County

Bullion Hill—The installation of the mill is completed.

Mono County

Masonic Mountain—An upraise is being driven to connect with the True Friend shaft. When this is completed in May the exposed orebodies will be developed.

Monterey County

Los Burros district is still attracting prospectors and locators. Plaskett brothers and others have recorded 25 locations and some rich pockets have been opened.

Nevada County

Eagle Bird—It is reported that this mine, one of the oldest producers in Washington district, has been sold to San Francisco capital, and will be reopened under the management of the former owner, W. M. Wilson.

West Point—This former producer, which has been idle for five years, is to be reopened by San Francisco men, under a bond held by Alfred Onn. The examination is in charge of H. H. Estee, Grass Valley.

Riverside County

W. A. Patterson, developing property in the Chuckawalla mountains, has opened good ore in a tunnel 25 miles northeast of Imperial Junction with fair prospect of warranting the installation of a stamp mill.

Santa Barbara County

Pinal Oil Company—An option of purchase has been obtained on this property in Santa Maria field by G. G. Gillette, said to represent the New York and Boston capital, which recently purchased the Graham-Loftus property. The main part of the holding is a 900-acre tract, on which there are 27 wells, producing more than 40,000 lb. monthly. The company has paid approximately $1,000,000 in dividends since 1902. The sale price is said to be $2,000,000.

SAN BERNARDINO COUNTY

Bob Young—This property near Barnwell is reported to have been sold to Philadelphia capital for $150,000. It is a low-grade mine on which some 7000 ft. of work has been done.

SIERRA COUNTY

Tightner—An option of purchase on this mine at Alleghany has been obtained by J. M. O'Brien, of San Francsco. The examination is being made by C. C. Derby and L. N. Wagner, of Nevada City. The option extends to Aug. 1 next.

SHASTA COUNTY

The Western Gold Dredging Company has begun work at the confluence of the Sacramento and Middle creek. The Yosemite Investment Company has spent a week testing the ground in the same vicinity. Both boats are on ground controlled by the patentee of the boats, G. A. Du Bois, of the Byron Jackson Iron Works.

Noble Electric Steel—Two carloads of electrical machinery arrived at Heroult, making the second consignment for the extended plant; the structural steel for the furnaces is expected soon.

Little Nellie—The new 10-stamp mill at this quartz mine, adjoining the Iron Mountain copper mine, was put in commission May 30.

Mt. Shasta—This mine has been unwatered to the first level, or to a depth of 75 ft. There are six levels varying in length from 50 to 400 ft. The depth of the shaft is 400 ft., not 600 as previously reported. H. A. Clarke of Shasta is superintendent.

TUOLUMNE COUNTY

Black Oak—This old mine near Soulbyville is reported to have reached a point in the search for the lost vein that insures its return to the producer class. The vein is said to have been cut for a distance of 5 ft. in one of the deep levels without reaching the footwall. There is a 40-stamp miil, canvas plant and cyanide plant on the ground that can be put in repair with moderate expense. Mr. Knox is superintendent.

Badger—This mine, on Humbug hill, has been unwatered, and development is being pushed. H. L. Ellis, Jamestown, owner.

Harvard—This mine has continued operations since the destruction of the transformer and building by fire, with a temporary machine secured from the Santa Ysabel.

YUBA COUNTY

Marc Antony—A lode carrying pay ore has been disclosed by a crosscut tunnel in this mine at Smartsville. The development is said to be sufficient to warrant the installation of a small stamp mill.

Colorado

CLEAR CREEK COUNTY

Clyde B.—James Beshears, owner of the Clyde B. property, will soon have ready another shipment of 50 tons of high-grade ore. Work has been started in the crosscut tunnel to undercut the incline shaft at an increased depth of 150 feet.

Katie Emmett—W. W. Cannady has brought in the first retort of 29 oz. of gold from the Katie Emmett mill, at Idaho Springs, which was built this spring on the mine on Cascade creek. The material from which the gold was recovered was for the larger part the old dump material, though the vein matter broken in driving the drifts on the vein were milled.

Oneida—After several months of delays, Messrs. Owen and Rogers have opened in the Oneida mine, at Freeland, a vein of rich smelting ore. This was encountered last summer in the tunnel level, but in stoping it was found that grade decreased in the stope. The present drift is over 100 ft. below the tunnel level, and the orebody is larger and of higher grade as depth is attained.

GUNNISON COUNTY

A discovery of rich ore has been made in the Elk Mountain country in the Treasury Mountain tunnel at 150 ft. from the portal. This is a long tunnel project and the ore was not expected at this point.

LAKE COUNTY—LEADVILLE

Chrysolite—Burton White & Co., leasing on the Chrysolite, are developing a body of zinc ore that is improving each day. In places the orebody is 12 ft. wide, and the grade is around 36 per cent. zinc. Only a short time ago this was an idle mine, and the owners were apparently unwilling to work it. A short time after the present leasers took charge, ore was found, and now the property is a steady shipper, with every assurance that it will put out a big tonnage of ore.

Silver Spoon—The Silver Spoon shaft, on Prospect mountain, has reached 475 ft. and the flow of water is so heavy that the management has decided to suspend sinking for the present and make connection with one of the lower drifts of the Valley. The granite in the Silver Spoon was entered at 435 feet.

TELLER COUNTY—CRIPPLE CREEK

Isabella—From the Lee shaft of the Isabella estate, lessees shipped 31 cars in May, the average grade being $20 per ton. The Empire State, one of the Isabella shafts, under lease to the Western Investment Company, sent out 14 cars of milling grade ore.

Granite—The several shafts of the Granite property sent out 50 cars of $25 ore in May, nothwithstanding that the big compressor at the Gold Coin was down two weeks. During that period the output was increased as leasers devoted all of their attention to hoisting rock from the filled stopes. The Dillon and Monument shafts were the heaviest producers, but these properties were never troubled because of the lack of air, securing power from the Ajax compressor.

Ajax—From the Ajax mine, on Battle mountain, 45 cars were sent out in May, the average value of which was $20 per ton. Three sets of lessees are shipping about the same quantity of four cars per week.

Idaho

COEUR D'ALENE DISTRICT

Hercules—August Paulsen, of Spokane, largest individual owner in this mine, at Burke, reports that the new mill at Wallace is handling 400 tons per day and is making the highest extraction of any concentrator in the Cœur d'Alene district. Between 500 and 600 tons of crude ore is shipped monthly to the smeltery. The new oreshoot tapped on the No. 4 level, has been proved for 300 ft. and, while no upraising or sinking has been done, the management feels confident it will develop into an orebody of importance with depth.

BLAINE COUNTY

Boulder Consolidated—This company, William Schultz superintendent, is driving a tunnel on Boulder creek 25 miles north of Hailey. The tunnel is in 800 ft. and will be driven 4000 feet.

IDAHO COUNTY

Elk City Reduction Company—Work is progressing on the custom mills at Elk City, Idaho, and it is expected to begin operations in July, sufficient ore having been pledged to keep the plant running steadily throughout the summer. John W. Lloyd is general manager.

Indiana

KNOX COUNTY

In digging a test well for coal on the W. M. Campbell farm one mile south of Oakland City, T. C. Bugg found a 6-ft. vein of coal. An exhaustive test of the country south of Oakland city is being made and the result of the hole just completed assures the opening of a mine. There are more oil people in the Oakland City field than there have been for three months. Drillers are at work in numerous places. The completed wells are holding up well under the pumps and the operators are greatly encouraged.

VIGO COUNTY

The work of transfering the Alliance properties by the Monon Coal Company was completed June 5. These properties include 20,000 acres of coal and 17 mines in this and the adjoining counties of Sullivan, Clay and Greene. The Chicago banks which underwrote the Walsh debt at the time of the settlement of the John

R. Walsh affairs, have just realized $3,000,000 more through the sale of the property and business of the Alliance Coal Company originally started as an important investment for the old Chicago & Southern Indiana railroad. Papers signed show that the Monon Coal Company is affiliated with the Chicago, Indianapolis & Louisville Railway in this extensive transaction.

Kentucky

Kentweva Coal Company—This company, of Elkins, W. Va., has purchased 10,382 acres of coal land in Harlan and Leslie counties from the Greasy Fork Coal and Timber Company, and will proceed with development.

New Straight Creek Coal Company—This company, which has its office at Winchester, Ky., has begun operations on its coal land at Blanche, on the Straight Creek branch of the Louisville & Nashville.

Michigan

Copper

James R. Finlay, who was recently appointed State mine appraiser in charge of the revaluation of the mining properties, has made the following appointments as his assistants: Prof. C. K. Leith, of the University of Wisconsin, William Hague, of Grass Valley, Cal. and Horace F. Lunt, of Colorado. Professor Leith will have charge of the iron properties; Mr. Hague will assist Mr. Finlay with the copper mines and Mr. Lunt will look after the salt, gypsum and coal properties in the southern part of the State.

Hancock—The official returns for the milling operations on this company's rock have been given out with the following results: Average yield of refined copper per ton from the starting of milling operations to June 1 was 19.27 lb. Everything at the mine is running smoothly and the large vertical shaft is going forward to the Pewabic lode—openings on No. 3 lode continue most encouraging.

Old Colony—H. F. Fay, president, announces to the shareholders: "In the summer and fall of 1910 a series of diamond-drill holes on the St. Louis property encountered a lode of marked value, and Mayflower also secured a rich diamond-drill core from an amygdaloid lode 20 ft. wide, which was well mineralized for practically its whole width. Our effort since that time has been to connect these two beds with one of the best of the amygdaloid lodes on the 1200 acres owned by your company when the cross-section of the property was made about ten years ago. We believe we have established this connection, and if our correlation is correct, we shall show that the lode cut on the St. Louis property is really the Old Colony amygdaloid, and that it is identical with the lode discovered on the Mayflower lands. It should, therefore, extend for over a mile across the Old Colony property, with a length of about three miles, all lying in the eastern horizon of the mineral range. Your directors now feel that they have secured sufficient data on which to begin active mining operations again." An assessment of $1 a share is levied.

Gogebic Iron Range

Norrie—"A" shaft, of the Norrie group, has closed for two months to permit of repairs being made to the shaft.

Newport—This company is expected to increase its force by about 350 men at once.

Mikado—This Pickands-Mather property, at Wakefield, was shut down recently, thereby throwing 150 men out of employment.

Pickands-Mather—Recent reports are to the effect that this company will ship about 275,000 tons this season from its properties at Wakefield and Hurley.

Menominee Iron Range

Baker—Surface improvements are being made at this Corrigan-McKinney property in the Iron River district. A steel-and-concrete change house to accommodate 200 men is being constructed.

Aronson—This is a prospect in the Iron River district. Exploration is being done by the Geary Powers Exploring Company and one diamond drill is employed. The intention is to put down several holes to 1000 ft. Some ore has been found, and as the property adjoins the Kaseco mine, of the Pickands-Mather company, which is a proved property, there is a good reason to believe that a commercial deposit exists on this tract also.

Minnesota

The American Bridge Company has received the contract from the Minnesota Steel Company for the steel work in the superstructure for the open-hearth furnaces, which will be erected at the steel plant in West Duluth. The concrete foundations for these furnaces are complete, and the steel for the structures is on the road. When this arrives, work is to be rushed forward with all possible speed.

Mesabi Range

Shenango—The openpit mine, near Hibbing, has started its season's shipments and three steam shovels are working on both day and night shifts. The output will amount to 200 cars daily.

Crosby—The Crosby mine, near Nashwauk, started shipments recently with about 20 cars daily. This will be increased soon to 35 cars. There is a large stockpile on hand from the winter's work, which will keep one steam shovel busy all summer. About 175 men are employed, and the force is being increased.

Missouri

Four leases have been started up on the Knight land in Lehigh; this camp is the scene of a great deal of prospecting. Frank Nicholson and associates have brought in one of the best drill strikes in the district on the Knight land.

Montana

The report of T. B. Miller, assayer in charge of the Helena assay office, shows a total of $114,850 in gold, received from Montana in May. Of this amount, $50,738 was received from Chouteau county, which leads all others. The gold received from the counties is as follows: Broadwater, $950; Chouteau, $50,738; Fergus, $21,697; Granite, $37; Lewis and Clark, $13,974; Madison, $22,974; Missoula, $4105; Park, $174; Silver Bow, $298.

Butte District

Anaconda—The old hoisting engine of the West Gray Rock mine, which was badly smashed in an accident that occurred some time ago, is being replaced by a new engine with a capacity for hoisting from a depth of 2000 ft., and the mine will be in operation again soon. The old engine was able to hoist from a depth of 1100 ft. only. The work of remodeling the hoisting engine of the Diamond mine is being rapidly carried on, and it is expected that by the end of June, at the latest, the engine will be operated by the use of compressed air, this being the second engine in the Butte camp to use compressed air as the motive power.

Raven—Repair work on the shaft is nearly completed, the timbers from the 700-ft. level to the surface, having been practically all replaced by new. A raise from the 1100-ft. level has now reached the 900-ft. level, and will be continued to the 700-ft. level, where it will be connected to the shaft by a crosscut, to be started at once. With this connection made, a series of raises will have been completed from the 1100-ft. level to the surface, in compliance with the law requiring two or more openings into all mines. The lower levels have not been worked in some time, and have been allowed to fill with water, but the pumps are soon to be started, after which mining will be resumed. The upper levels are being worked by leasers, and one car shipped by them recently, netted over $1000.

Cascade County

The abandoned camp of Neihart, which has been famous as a silver producer, will be worked again. The United States Smelting, Refining and Mining Company has awarded a contract for pumping out the Queen-of-the-Hills, Gault, and Nevada, mines, and if they pass inspection, the bond given the company by W. G. Conrad, will be taken up, and operations started.

DEER LODGE COUNTY

Iron Mask—John Hamill and Thomas McGrath, of Anaconda, have just made a trip to the Iron Mask property in the Gold Coin district, owned by Fred Gangner and Victor Gibault, of Anaconda, for the purpose of sampling the mine with a view to purchase. Besides the Iron Mask, there are two other claims, and considerable work has been done on the property, including a tunnel driven 150 ft., and a winze on a vein tapped at 60 ft. below the surface.

LINCOLN COUNTY

Snowshoe—The Snowshoe mine near Libby, is now operating with George E. Adams, of Burke, Ida., acting as superintendent, and 75 men are employed. The concentrator is running steadily; shipments will begin as soon as the Libby Lumber Company railroad has been completed to the mine. Consulting Engineer E. H. Wilson, who has had charge for the Pacific Coast Smelting and Refining Company, has returned from California.

MADISON COUNTY

St. Lawrence—The Uncle Joe Mining Company, which is operating the St. Lawrence mine, near Virginia City, under lease and bond from its owners, Baker, Mahagin and Dullea, has completed the installation of a gasolene hoist, with a capacity for hoisting from 350 ft. The shaft is down 170 ft., and at 150 ft. a level has been started. The orebody varies from 2.5 to 12 ft. in width. A car of the ore is just being shipped to Washoe for a test run, and if this proves satisfactory, regular shipments will be commenced.

Nevada

COMSTOCK LODE

Mexican—Returns on eight cars of first-class ore shipped last week give a net profit of $22,000, the ore averaging $85 per ton. The company is stoping ore from the 2300, 2400 and 2500 levels. The new ore shoot is showing up strong on the 2500 level, a north drift having been driven ahead for a distance of 20 ft. in high-grade ore, of which some of the cars assay considerably in excess of $100 per ton. The vein on this level has now been opened over 50 ft., width yet to be determined. Sinking below the 2500 level will probably soon be started.

Ophir—A south drift has been started in the vein from the east crosscut on the 2500 level, and will tap the oreshoot opened on the 2400 level, which was high grade.

Ward Shaft—A bulkhead is being constructed of concrete in the south drainage drift on the 2000 level, preparatory to tapping the water by means of diamond-drill holes on the corresponding levels of Yellow Jacket, Crown Point and Belcher mines. This drainage will mark a new epoch of development.

ESMERALDA COUNTY

Great Western—Work has been resumed on this property, at Hornsilver, by Russell Brothers. Ore will be shipped to the Bonnie Claire mill by wagon and rail.

LINCOLN COUNTY

Reeves—Fred Schrott has interested Chicago men in this mine, also known as the Fetterman, about half a mile from the depot at Caliente, and work has been commenced on the installation of a Lane mill on the property. Cyanide may be used later.

Day—This mine, of the Nevada-Utah, shipped 57 cars of ore in May. Actual production was greater than the previous month. A good strike was made on the 300 level of the Onondago, the claim from which most of the ore is shipped.

Pioche-Demijohn—This mine has installed an 18-h.p. Alamo gasolene engine to replace its horse whim, also another Alamo engine and a Chicago pneumatic 12x12-in. compressor and two Sullivan drills. The main shaft is down 200 ft. and will be continued to 400 ft. as quickly as possible. The property has already shipped several cars of galena carrying an average of about $8 in gold. Owen Bailey is manager.

Golden Prince—This shaft, of the Pioche Coalition, is now close to the 600-ft. level and will be continued to the 700.

Mendha—This mine closed down on June 1. No further work will be done until arrangements have been made to erect a mill.

NYE COUNTY

Jim Butler—Crosscutting north and south from the main southeast crosscut on the 600-ft. level is being continued chiefly east of the Stone Cabin fault in the zone of the continuation of the Silver Top veins of the Tonopah mine, but as yet no commercial orebody has been encountered.

Halifax—The company is planning a new shaft to 1500 ft. at a point 500 ft. east of the end line of the Tonopah-Belmont property. The shaft is intended to open up the extension of the Belmont vein. F. H. Smith, Oakland, Cal., is president, and Thomas F. Kearns, Salt Lake City, is vice-president of the company.

WHITE PINE COUNTY

Ely-Illipah is the name of a new silver-lead district, 35 miles west of Ely, in which much work is being done with reported good results.

Nevada Consolidated—The boarding house and three bunk houses burned June 1. Loss, $100,000.

Centennial—This Ely company will resume sinking. E. E. Vanderhoef has been made manager. The property is equipped.

New Mexico

Chino—A meeting of the stockholders is called for June 30, to approve a proposed issue of $2,500,000 first-mortgage 6 per cent. 10-year bonds, convertible into stock at 25, after July 1, 1912, for a period of five years. An increase of stock of 100,000 shares will also be passed on. Hayden, Stone & Co. have underwritten the bond issue. Proceeds from the bond sale will be used to pay for the entire equipping of the property, construction of the present 3000-ton mill an an enlargement of 2000 tons additional, making it a 5000-ton mill and also to supply working capital. The first section of the mill will start operation Aug. 1. The issuing of 100,000 shares additional stock was authorized to provide for the conversion of the new bonds.

Germany—This Boston company, operating in the Magdalena camp, at Socorro, reports an important strike of zinc-lead-silver sulphide ore.

Pennsylvania

ANTHRACITE COAL

Madeira, Hill & Co., have closed leases in the Mahanoy valley, covering the Lawrence, Stanton, Brookwood and West Bear Ridge operations, and will open up a large tonnage of anthracite coal, which has been lying undeveloped for some years. Two large breakers, it is reported, will be immediately built, with an annual output of at least 600,000 tons. Among the interesting engineering problems taken in hand in connection with the work is an unusual plan for handling the water at the Lawrence colliery, the seams at that point being very deep. These operations, with the known interests which Madeira, Hill & Co., have in other collieries in the Lehigh and Wyoming regions, will produce about 2,000,000 tons per annum, a much larger anthracite output than has ever been controlled by any other individual operator.

Philadelphia & Reading Coal and Iron Company—For the 10 months of its fiscal year from July 1 to April 30 this company reports gross earnings, $29,255,715; expenses, $28,795,978; net earnings, $459,737. As compared with 1909-10, there was an increase of $999,812 in gross receipts, but a decrease of $620,161 in net earnings.

Utah

The report of the local United States assay office for May shows that a total of $114,283 in gold and silver bullion was handled. This amount is smaller than the figures for May of last year, the decrease being due primarily to the closing down of the National plant at National, Nev., more than to any general decrease in output. During the month, there were 6061 oz. of gold, valued at $112,733, and 3298 oz. of silver received by the office. Of this Utah furnished about one-half.

JUAB COUNTY

Chief Consolidated—According to a report recently issued this company has shipped 10,302 tons of ore since beginning mining in Sept., 1909, up to April 30 of this year. From this was received $249,131 smelter returns, or an average of $24.19 per ton. Instead of declaring dividends this money has been used in part to provide efficient modern equipment. The shaft has been sunk to a depth of 1675 ft., but most of the development has been confined to the 1400 level. The property is well equipped, and in a position for economical development.

Lower Mammoth—Leasers are making steady shipments. Work on company account at the northern and western ends of the property is being considered. This part of the ground has not been heretofore developed.

SALT LAKE COUNTY

Utah Copper—Three sections of the Arthur mill are now revamped, and in operation, and two additional sections will be ready in July. The copper production in April is given as 8,169,248 lb., as against 7,260,267 lb. in March. The quarterly dividend of 75c. per share, amounting to $1,171,987 has been declared payable June 30. The company holds 1,000,152 shares of Nevada Consolidated stock, from which it will receive $375,057 from this company's quarterly dividend. The changes in the Arthur plant will be completed this fall.

Silver Shield—Drifting will be started on the 50-ft. level below Niagara tunnel. A 4-ft. vein will be followed.

Utah Apex—The new orebody opened on the lower tunnel level for 400 ft. along the strike and up to 54 ft. thick is being further developed. Shipping ore is broken without sorting or waste. Shipments of 150 tons and upward are being made daily. Two tons of ore are being developed for each ton shipped, though on account of the nature of the orebody in limestone, ore is being followed and mined rather than being completely blocked out.

Rexall—At the annual meeting, June 6, M. E. Price was elected president, John Gallinger, vice-president, S. Porter, secretary and treasurer, with M. R. Evans and J. T. Hodson additional directors. The working forces will be increased, and development pushed.

TOOELE COUNTY

Utah Mine—Several cars of ore have been shipped during the first half of May. Much of the ore carries up to 136 oz. silver and 44 per cent. lead, with about 60c. in gold. It is figured that the May settlement will be in the neighborhood of $6000. The property has produced for nearly 20 years in spite of a 70-mile haul to the railroad.

Canada

NOVA SCOTIA

Springhill—In the settlement of the the strike of coal miners, which has lasted 22 months, the men have accepted the report of the settlement committee. The union is not recognized and coal cutters submit to a reduction of 10 per cent. in the wages paid before the strike, in place of the 15 per cent. cut then announced by the management. No reduction is to be made in the pay of mechanics. The company states that it hopes to find employment for the majority of the men within 45 days.

ONTARIO

Henry Weill, of Buffalo, N. Y., has purchased five gold claims in the Lake of the Woods district, known as the Fanny, Wolverine, Empire State, Echo and Climax, comprising altogether about 200 acres, said to be rich in gold-bearing quartz veins. Mr. Weill will establish headquarters in Fort William or Port Arthur and develop the properties as soon as possible.

ONTARIO—COBALT

The shipments from Cobalt for the week ended June 2 were: Coniagas, 221,080 lb.; Crown Reserve, 161,500; La Rose, 128,410; McKinley-Darragh, 125,340; Trethewey, 72,350; Nipissing, 64,610; O'Brien, 64,020; Buffalo, 62,470; Kerr Lake, 60,050; Townsite, 47,980; total, 1,007,810 lb. Bullion shipments: Nova Scotia, 36,588 oz.; Crown Reserve, 22,272; O'Brien, 9310; Kerr Lake, 2000; total, 70,170 ounces.

The British Canadian Power Company, whose power substation was destroyed by fire, state that delivery will be resumed in a month.

Victoria—Work will be resumed on this Cobalt property which has been purchased by the Porcupine Gold Mines.

Trethewey—The report for this Cobalt property for May shows: Ore treated in mill, 3577 tons; jig concentrates produced, 37,641 lb.; table concentrates produced, 75,438 lb.; silver produced from concentrates, 75,485 oz.; silver from mine ore, 35,418 oz.; total silver for month, 109,903 ounces.

Nipissing—Ore production for May was as follows: First class, 164.97 tons; second class, 177.8 tons; total silver, 418,108 oz. Value of ore shipped, $219,898; value of ore mined, $221,584.

ONTARIO—PORCUPINE

West Dome—The power plant is completed and running. Power is being furnished for the six-drill compressor, the hoist and three shot drills. A new pumping station has been installed in place of the temporary one on Edwards lake. This station not only furnishes water for the power plant, but will be used for fire protection. Arrangements have been made whereby litigation has been averted between the West Dome and the Pell interests and West Dome will now be able to work the Curtis vein where ore will be immediately available.

Powell—It is reported that New York and Boston men have secured these properties, which adjoin the Imperial and Standard. The same formation and vein system on the Imperial and Standard is found on this property.

Vipond—The long high-grade ore shoot that has been stripped on the surface for several hundred feet has been cut at the 100-ft. level. It is stated to assay $40 per ton for a width of 3 ft., and $12 per ton for 2 ft. on each side of the quartz.

Tisdale—The discovery of a new 9-ft. vein running northeast, carrying good gold contents, is reported.

Hollinger—The deepest workings are on the 200-ft. level, where over 200 ft. of drifting has been done. The vein is from 4 to 20 ft. wide and the assays very variable, the high grade found on the 100-ft. level being duplicated in some cases. A quartz lead 24 ft. in width has been struck by a crosscut of 200 ft. from the north end of the main drift from No. 1 shaft, assays from which average $15 to the ton. The stamp mill is not expected to be ready before August, and owing to the large amount of ore on the dump, it has been decided not to undertake custom work. The main shaft will be enlarged to four compartments, and sunk to 500 ft. Wires from the Porcupine Power Company are in place, and the power is ready for delivery as soon as the stamp mill is in place and connections made.

Dome Extension—The main shaft is down to 75 ft. At the 100-ft. level a crosscut will be run to reach the vein, 30 ft. distant. This is 36 ft. wide on the surface, with four lateral veins.

Mexico

A strike for increased wages of the employees at the Asarco smelting plant, at Velardeña, and of the Torreon smelting plant, is reported.

CHIHUAHUA

Mexican Consolidated—Communications from Boston to Messrs. Stallforth of Parral advise that the underwriting of the stock and bonds of the reorganization is complete, and the operating of the mines and mill will begin June 15.

MEXICO

El Oro—Returns for May are: Crushed, 30,560 tons, yielding bullion, $207,010; working expenses, $104,120; expenditures on development, $19,530; profit, $83,360; railway profit, $10,000; total profit, $93,360.

SONORA

Cormers—The owners of this mine, two miles north of San Javier, are planning to reopen it.

The Markets

Coal Trade Review

New York, June 14—Coal trade in the West begins to show some signs of improvement, though so far there has not been much increase in business. Steam coal sales are a little better and buyers are beginning to talk about putting in stocks. Most mines are running at about 50 to 60 per cent. of capacity. Car supply and the movement of coal leave little cause for complaint.

In the East the bituminous trade is looking up a little, and operators are inclined to be hopeful. The trade is in good shape for an improvement.

Anthracite is quiet and steady. The very large production reported for May seems to have been absorbed without difficulty.

The Canadian Strike—An embarrassing shortage of coal has developed in the Canadian Northwest, owing to the continued strike of the miners in Alberta and British Columbia. The committee appointed by the Dominion government is pressing both parties to reopen negotiations for a settlement.

Coal Traffic Notes

Anthracite shipments in May were 6,317,352 long tons, being 320,458 tons more than in April, and the largest monthly shipments ever reported, with one exception. For five months ended May 31, the shipments were, in long tons:

	1910	1911	Changes
Reading	5,467,602	5,535,087	I. 67,485
Lehigh Valley	4,806,847	5,223,960	I. 417,113
N. J. Central	3,551,671	3,793,012	I. 241,341
Lackawanna	4,025,290	3,930,512	D. 94,778
Del. & Hudson	2,679,500	3,046,664	I. 367,164
Pennsylvania	2,684,096	2,864,725	I. 180,629
Erie	3,068,898	3,595,303	I. 526,405
N. Y., Ont. & West.	1,132,721	1,104,963	D. 27,758
Total	27,416,625	29,094,226	I. 1,677,601

The total increase this year was 6.1 per cent. Two companies—the Delaware, Lackawanna & Western, and the New York, Ontario & Western—showed decreases. The heaviest gain was made by the Erie.

Anthracite shipments from Buffalo by Lake for the season to June 1 were 926,470 tons in 1910, and 605,570 in 1911; decrease, 320,900 tons.

Coal tonnage of Chesapeake & Ohio railway 10 months of fiscal year from July 1 to April 30, short tons:

	1910	1911	Changes
Tidewater	4,263,392	3,481,944	D. 781,448
Points east	1,810,542	1,628,158	D. 182,384
Points west	6,486,904	7,696,030	I. 1,209,126
Total	12,560,838	12,806,132	I. 245,294

Tonnage carried to tidewater this year was 27.2 per cent. of the total; to points east of mines, 12.7; to points west of mines, 60.1 per cent.

Current Prices of Metal, Minerals, Coal and Stocks, Conditions and Commercial Statistics

Coal passing through Sault Ste. Marie canals season to June 1, short tons:

	1910	1911	Changes
Anthracite	467,042	266,822	D. 200,220
Bituminous	1,579,224	1,792,324	I. 213,100
Total	2,046,266	2,059,146	I. 12,880

Notwithstanding the late opening of Lake shipments, bituminous coal shows a good increase this year.

New York

Anthracite

June 14—The trade is quiet and steady, and is apparently pretty well down to a summer basis. Supplies are good, except that buckwheat has been a little short.

Schedule prices for domestic sizes for June are $4.45 for lump, $4.70 for egg and stove and $4.95 for chestnut, all f.o.b. New York harbor. On steam sizes quotations are: Pea, $3@3.25; buckwheat, $2.30@2.75; No. 2 buckwheat or rice, $1.80@2.25; barley, $1.45@1.70; all according to quality, f.o.b. New York harbor.

Bituminous

The seaboard market does not show much change, but there is a better feeling in the trade, and a more hopeful tone. Harbor trade is dull still, but coastwise business is looking up and all-rail trade is also reported better. Shipments to tide are still limited and there is no special pressure to sell coal. Lake trade is beginning to have effect on shipments also.

Prices run about the same. A fair Miller vein steam coal can be had at $2.50, f.o.b. New York harbor. Lower grades sell down to $2.30, and better up to $2.85. Gas coals are $1.10 for ¾-in. at mines, $1 for run-of-mine and 75@85c. for slack.

Coastwise vessels are in good supply. There has been no change in rates, but the tendency is weaker. From Philadelphia large boats get 60@70c. to Boston and Portland. From New York going rates are 55@60c. to Boston and Portland, with 10c. more to the shoal-water ports; 35@40c. to Providence and New Bedford; 25@30c. to Sound ports. From Hampton Roads to Boston, 60@70c. is asked.

Birmingham

June 12—Coal operations in Alabama are still off as compared to what they were. However, the prospects are now brighter than they have been. It is learned that several contracts for coal in quantity have been secured, but delivery will hardly start until August or September. Some shipments are to begin in the next few weeks.

Coke ovens are being started up in various parts of the coalfields of Alabama.

Chicago

June 12—Summer quiet is upon the coal trade generally, the demand for steam coals being light though steady, and hardly any sales for domestic, except anthracite, which has a good demand for a summer month. There is hardly any prospect of a revival, considering the course of business. Shipments from western and eastern mines are in general well restricted and caution should be used in sending any kind of coal to the Chicago market.

Illinois and Indiana coals bring $1.85@2.25 for lump and egg, $1.75@1.90 for run-of-mine and $1.65@1.85 for screenings. The last named size continues strong. Of Eastern coals Hocking is steady at $3.15, and smokeless is weak at $3.55 for lump and $3.15 for run-of-mine nominally, though these prices are cut 15 or 25c. on some sales. Specialties are quiet, owing to the general slackness of business. The harvesting trade, already begun, bids fair to be heavy and the demand is for high-grade coals, which will do much to hold up the market.

Cleveland

June 12—While local trade is still quiet, there is some improvement in the demand for steam coal. Lake shipments are improving.

Prices are unchanged, except that slack is plentiful, owing to the increase in Lake coal; it can be had down to $1.40, Cleveland, though the nominal quotation is $1.60. Pocahontas is very scarce.

Indianapolis

June 12—There is very little change to be noted in the coal trade in Indiana. Two points are encouraging, the first being that the call for steam coal is improving, though slowly; the other is that the Lake ports are beginning to take more coal. Most of the mines continue to run about half time, the exception being with those which have special contracts.

Pittsburg

June 13—The local coal market continues dull, with mines running slack

on account of light domestic demand and small lake movement. Prices are moderately well maintained, and we continue to quote: Nut, $1.05@1.15; mine-run, $1.10@1.15; ¾-in., $1.20@1.25; 1¼-in., $1.30@1.35; slack, 75c. per ton at mine.

Connellsville Coke—Additional official information on the Steel Corporation's purchase of the Pittsburg Coal Company's coke properties, held by its subsidiary, the Colonial Coke Company, shows that the price was $1450 an acre for a few acres over 7000, with 956 ovens and other improvements. What the improvements are rated as worth is not known, but some estimates put them at $3,000,000 which, deducted from the gross sum would leave barely over $1000 an acre for the coal alone. This is the lowest price done on Connellsville coal for a long while, but is in conformity with the view the coke department of the Steel Corporation has always held, that in the nature of things Connellsville coking coal could not be worth much, if any, over $1000 an acre. The coal taken from the Monongahela River Consolidated, assumed to be coking coal, but entirely undeveloped, is about 9000 acres, at $850 an acre. An error in this report a week ago produced the inference that this deal would not benefit the coke market in the long run, whereas the idea is that while at present, with such light demand, no particular effort is likely, whenever a full demand develops the market supplies will be exhausted sooner, and there will then be a beneficial effect upon prices through this absorption of the product of about a thousand ovens.

The Colonial Coke Company had a production of about 58,000 tons of coke a month, of which between 35,000 and 40,000 tons were sold, on long-term contracts, many of them being requirement contracts and therefore not involving the full tonnage in times like the present, but promising to take up their full tonnages should times become active. In such times the Steel Corporation would desire the output itself, and there is, therefore, reason to suppose that negotiations will be undertaken for the cancellation of these contracts, although thus far nothing has been done.

The coke market has been very quiet the past week. There has been considerable prompt coke waiting to be moved, and offered at lower prices than formerly, down to $1.40 and possibly lower. Asking prices on contract have not been revised. McKeefrey & Co. have sold Corrigan, McKinney & Co., for their Genesee, N. Y., furnace, coke for its requirements, about 9000 tons a month, from June 15 to Aug. 1, at $1.40, at ovens, the lowest price done for some time on such a delivery. The American Locomotive Company and American Steel Foundries have been negotiating for their foundry-coke requirements for the twelvemonth, beginning July 1, but have not closed, the total requirements of the former, running full, being close to 20,000 tons, while the latter would need somewhat over 10,000 tons, running full. We quote prices unchanged, except dropping prompt furnace coke 10c. a ton: Prompt furnace, $1.40@1.50; contract furnace, $1.75@1.85; prompt foundry, $1.90@2; contract foundry, $2@2.25, at ovens.

The *Courier* reports production in the Connellsville and lower Connellsville region in the week ended June 3, at 269,256 tons, a decrease of 1500 tons, and shipments at 3164 cars to Pittsburg, 4636 cars to points west and 535 cars to points east, a total of 8335 cars.

St. Louis

June 12—The wholesale market shows no change from last week. There seems to be a tendency, however, in the steam plants, to shut down on July 1 for 30 to 60 days for repairs. The foundries seem to be slowing up all over, though the cement plants and the firebrick companies are still running full. Plants that depend on the railroad for business do not seem to be running more than half time, but manufacturers that place their products with the general public, seem to be doing very well.

Current prices of coal in the St. Louis market are as follows:

Standard:	F.O.B. Mine	F.O.B. St. Louis
6-inch lump	$0.85	$1.27
2-inch lump	0.75	1.17
2-inch screenings	0.75	1.17
Mine run	0.75	1.17
2-inch nut	0.85	1.27
Staunton and Mt. Olive:		
6-inch lump	1.30	1.82
2-inch lump	1.25	1.77
2-inch screenings	0.75	1.17
2-inch nut	0.90	1.42
Carterville:		
6-inch lump or egg	1.15	1.82
3x2-inch nut	1.05	1.72
2-inch screenings	0.75	1.42
Trenton:		
6-inch lump or egg	1.75	2.27
3x2-inch nut	1.50	2.02
Franklin County:		
6-inch lump or egg	1.40	2.07
3x2-inch nut	1.20	1.87
Pennsylvania Anthracite:		
Chestnut		6.90
Stove or egg		6.65
Grate		6.40
West Virginia Smokeless:		
Lump or egg	1.50	4.00
Mine-run	1.10	3.60

East St. Louis prices are 20c. per ton lower on Illinois soft coal.

The event of the week in the retail trade has been the letting of the School Board contract, amounting to about 225,000 tons of bituminous coal and 1500 tons of anthracite coal. All this business was taken by the Polar Wave Coal and Ice Company; bituminous at $1.71 and anthracite at $7.19 for the entire city. This is the closest piece of business ever figured around St. Louis, as every pound of this coal has to be teamed and stored. In some instances the hauls are quite long. The contract calls for 2-in. lump coal, to be inspected both in the car and at the school. The coal is to be forked over a 1⅛-in. fork, and coal to be weighed by the school board. The one redeeming feature of this business is that it can be stored during the summer months. This bid was 9c. cheaper than the nearest competitor.

Anthracite—The movement during June has been good, though the bulk of the tonnage was shipped on orders carried over from May. The amount of June business booked was about up to the average. Producers have not yet caught up with their back orders.

FOREIGN·COAL·TRADE

Russian Coal Production—The production of coal in Russia for the year 1910 is reported as follows: Donetz basin, 16,353,000; Poland, 5,476,000; Urals, 559,000; Moscow district, 223,000; Caucasus, 39,000; total, 22,650,000 metric tons, a decrease of 1,420,000 tons from 1909. Coke production was 2,698,000 tons, an increase of 117,000 tons over 1909. Briquets made, 146,000 tons, a decrease of 34,000 tons.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report prices of coal on June 3, as follows: Best Welsh steam coal, $4.38; seconds, $4.14; thirds, $3.96; dry coals, $3.84; best Monmouthshire, $3.72; seconds, $3.54; best small steam coal, $2.52; seconds, $2.22. All prices are per long ton, f.o.b. shipping port, cash in 30 days, less 2½ per cent. discount.

IRON·TRADE·REVIEW

New York, June 14—While the iron and steel markets have not yet abandoned the waiting position, there is, apparently, a rather better tone and a greater disposition to buy material. In part this may be due to recent favorable crop reports and a more optimistic general feeling. It is also reported that some of the leading independent interests are taking business freely on favorable terms. Another symptom is that specifications on contracts are reported to be coming in better than for some weeks past.

In finished material there is rather less activity in structural material, which may result from the fact that most of the large pending contracts have been placed. The business now coming in is in smaller orders. The Missouri Pacific has placed orders in all for 72,600 tons of rails, divided among the Steel Corporation, the Tennessee Coal, Iron and Railroad Company and the Colorado Fuel and Iron Company. Several small orders for rails have been placed and an order for 40,000 tons for the Southern Pacific is understood to be pending. Several good export orders are under negotiation.

In pig-iron business has been on rather

a larger scale, especially in seaboard territory. Makers are showing a disposition to grant small concessions. Buyers are holding back a little in the hope of securing more. Southern iron has settled down definitely to the basis of $10.50, Birmingham, and this price seems to be accepted for the balance of the year.

A sale of 2000 tons of Panama Canal scrap is reported at $10.67 per ton, Philadelphia, all around.

Steel Corporation Orders—The unfilled orders on the books of the United States Steel Corporation on May 31 reached a total of 3,113,187 tons; a decrease, as compared with April 30, of 105,517 tons.

Lake Superior Iron Ore—Shipments of iron ore from the Lake Superior region for the season to June 1, are reported by the Cleveland *Iron Trade Review* as follows, in long tons:

	1910	1911	Changes
Escanaba	972,117	529,540	D. 442,577
Marquette	616,885	218,931	D. 397,954
Ashland	807,307	267,865	D. 539,442
Superior	1,310,958	1,315,892	I. 4,934
Duluth	2,530,185	947,155	D. 1,583,030
Two Harbors	1,364,213	737,081	D. 627,132
Total	7,601,665	4,016,464	D. 3,585,201

Receipts of ore at Lake Erie ports in May were 2,633,357 tons. The total decrease in shipments this year was 47.2 per cent.

Baltimore

June 12—Exports for the week include 2,168,800 lb. steel billets to Liverpool; 158,661 lb. tin scrap to Rotterdam. Imports included 3694 tons pyrites from Huelva, Spain; 5000 tons iron ore from Cuba.

Birmingham

June 12—There is encouragement in Southern territory over the early resumption of operations at the big steel plant of the Tennessee company, at Ensley. The works will start up June 16. Announcements are also made of the resumption of a number of coke ovens, coal mines and other works.

The pig-iron situation in the Southern territory shows little, if any, improvement. The production is above the demand. The reduction in iron prices did not bring about any activity. The quotation now is $10.50 for No. 2, foundry, and it is stated that contracts at that price have been made running over the last half of the year. The curtailment in production during the month of May was considerable. In all probability there will be a further curtailment during the present month, though no definite announcements are made.

Machine shops and foundries are still doing a little work in the South while considerable iron is being melted at the cast-iron pipe plants. A change in management at one of the larger independent cast-iron pipe plants in the Birmingham district will mean a resumption of operations shortly.

Chicago

June 12—There is no important change in the market for pig iron; for iron and steel products there is a better demand, though sales have not been much affected yet by price reductions, and the impression of consumers seems to be that further reductions will be made. Melters of pig iron are still in the waiting mood, and prices drag. For Southern No. 2 $10.50, Birmingham, is openly quoted, or $14.85, Chicago, some sales being made at a little higher price. Northern No. 2 is very quiet and is quoted at $15 nominally, though selling for perhaps 50c. less in some cases. The reduction of output of Northern iron has made that iron firm compared with Southern. Sales are for small amounts of iron, mostly for third-quarter delivery, with here and there an order covering the needs of the purchaser for the last half. Foundry business in general is at a low ebb, and does not seem likely to revive soon. Yet inquiries are somewhat numerous again, showing at least a close watching of the market.

Cleveland

June 12—No additional sales reported. There is some talk of concessions to effect sales, but none are known to have been made. Cleveland receipts for the season to June 1 were 480,602 tons.

Pig Iron—Sales are chiefly in small lots, and buyers hesitate to commit themselves far ahead just yet. Quotations, Cleveland delivery, are $15.90 for bessemer; $14 for basic; $14.25 for No. 2 foundry; $13.25 for forge iron.

Finished Material—Several contracts for structural steel have been let and others are pending. On most other lines buyers are holding back until matters are more settled. Jobbers, however, report improved trade on the lower prices.

It is announced here that the United States Steel Corporation has acquired full control of the Basset-Pressley Company, of this city, one of the largest jobbing concerns in the country. This means further extension of the policy of direct dealing in steel products and elimination of the jobbing interests.

Philadelphia

June 14—But little business has been done in crude iron since the recent reductions went into effect. This is in part due to the fact that quite a number of large consumers have iron enough for the present. The shadings in Southern irons had not much time to bring business before a shading was made in Pennsylvania irons also; but the Southern makers are very persistent in their efforts to make sales for as late as fourth-quarter delivery. The fact is, everyone is waiting to see what is likely to happen. Some dealings in basic, which were to have gone through by this time, are suddenly held up without any known explanation. A good brand of No. 2 X foundry can be had at $15.25, and another at $15. Forge is quite uniformly held at $14.50. Basic is offered at $14.50, without any takings to speak of.

Steel Billets—The lower quotations have rather discouraged than stimulated business. Business in forging billets is regular, though the purchases are trifling.

Bars—The movement in refined bars is very light. A few inquiries for common iron just received will probably result in business.

Sheets—The sheet card is maintained at 2.30c., with sales for immediate necessities, and no success in booking orders for late delivery.

Pipes and Tubes—The market is flat and not a single order of consequence of tubes can be traced up. A prolonged strike in the Baldwin Locomotive Works appears to be inevitable.

Plates—Steel plates continue to hold their own at the reduced price and the market is active for small lots and early deliveries.

Structural Material—Several trifling orders have been booked, for local requirements and southern delivery. Manufacturers are much encouraged by the inquiries received during the past week.

Scrap—Scrap sales for the week doubled the sales of any previous week for some times. Railroad and No. 1 yard scrap chiefly figure.

Pittsburg

June 13—There has been a slight improvement in bookings of finished-steel products, but the improvement is not noteworthy, and may not be continued. The number of orders has increased, and there has been a little increase in the average size. The market is still extremely dull. While the opinion in the producing trade is practically unanimous that there will be a decided improvement in tonnage before long, there is diversity as to whether it will occur this month or not until August or early September. For many weeks buying has been below the minimum requirements of the country, according to all estimates, sentiment being injuriously affected by many causes. As the country is bare of stocks it is believed some improvement must soon occur.

Prices of steel products are being quite rigidly maintained. On the whole, there is less shading than there was before the recent cuts, as the new prices on sheets are too low to leave room for cutting, and the merchant-bar market has been equalized.

Pig Iron—The long deadlock as to large lots of foundry iron has been broken by the Standard Sanitary Manufacturing Company taking 1000 tons of forge on the basis of $13, Valley, and 1000 tons of No. 2 foundry on the basis of $13.50,

Valley, June and July delivery, to its Allegheny and New Brighton plants. A portion of the iron does not come from the Valleys, however. The foundry iron was at 25c. less than had been done on the small lots which constituted the only trading, and the market is quotable at $13.50 @13.75 instead of $13.75 flat. Basic is quotable 25c. less than last week, there being a number of sellers at $13, Valley, although this price has not been openly named by any of the furnaces. The pig-iron market continues stagnant except for the development in foundry iron. We quote, f.o.b. Valley furnaces, 90c. higher delivered Pittsburg: Bessemer, $15; basic, $13@13.25; No. 2 foundry, $13.50@13.75; gray forge, $13@13.25; malleable, $13.25@13.50. The Commonwealth Steel Company, St. Louis, has bought 5000 tons of basic, presumably from Columbus furnaces, delivery over the last five months of the year.

Ferromanganese—The market continues quiet and unchanged at $36.50, Baltimore, for prompt for forward.

Steel—Nothing of importance has been done in the market, and deliveries on billet and sheet bar contracts are somewhat less. We quote, f.o.b. maker's mill, Pittsburg or Youngstown, $21 on billets and $22 on sheet bars. Wire rods continue nominally at $29, Pittsburg.

Sheets—The volume of sheet business has increased slightly since the radical cut in prices, but is still rather light, and mills are running only at about 60 per cent. of capacity. The new prices are being strictly held and we quote them as follows: Black sheets, 28 gage, 2c.; galvanized, 3c.; blue annealed, 10 gage, 1.50c.; painted corrugated roofing, $1.40; galvanized, $2.55 per square.

St. Louis

June 12—After making the rounds of the foundries this week, it was discovered that they have more pig iron on hand than was generally supposed. The fact that buying has been light in small lots has rather given the impression that stocks must be low, though it was found that such is not the case. The price of $10.50, Birmingham, or $14.25, St. Louis, remains the current figure for No. 2 foundry.

FOREIGN IRON TRADE

German Iron Ore Consumption—The consumption of iron ore in Germany for the year is estimated as below, in metric tons:

	1909	1910	Changes
Ore mined	25,504,464	28,709,654	I. 3,205,190
Imported	8,366,599	9,816,822	I. 1,450,223
Total	33,871,063	38,526,476	I. 4,655,413
Exported	2,825,007	2,952,634	I. 127,627
Consumption	31,046,056	35,573,842	I. 4,527,786

The approximate consumption in 1910 was 2.4 tons of ore per ton of pig iron made.

METAL MARKETS

New York, June 14—The features of the markets this week are the increasing strength of copper; and the extraordinary prices of tin forced by the Syndicate operations in London.

MONTHLY INDEX NUMBERS

Month	1910	1911	Month	1910	1911
January	127	110	July	112	.....
February	124	115	August	113	.....
March	118	112	September	114	.....
April	118	114	October	111	.....
May	113	118	November	117	.....
June	107	.....	December	115	.....

Year 1909, 115; 1910, 115.

Numbers for each month and year calculated on approximate sales of pig iron, copper, tin, lead, zinc and aluminum.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold:			
April 1911	$1,505,634	$ 4,524,835	Imp. $ 3,019,201
" 1910	36,283,625	2,100,918	Exp. 34,182,707
Year 1911	3 359,658	23,990,572	Imp. 20,630,914
" 1910	47,275,749	13,499,276	Exp. 33,776,473
Silver:			
April 1911	7,610,154	4,251,532	Exp. 3,358,622
" 1910	4,696,534	3,840,495	" 856,039
Year 1911	23,611,196	14,998,313	" 8,612,883
" 1910	18,336,083	15,238,634	" 3,097,449

Exports from the port of New York, week ended June 10: Gold, $24,825; silver, $1,138,200, principally to London. Imports: Gold, $275,417; silver, $131,274, from South and Central America and Australia.

Gold—The price of gold on the open market in London continued at the normal level, 77s. 9d. per oz. for bars, and 76s. 4½d. per oz. for American coin. In New York an additional $1,000,000 was taken for Canada. There is talk of gold imports from Europe, but none have been made up to date.

Platinum—The market continues steady. Dealers ask $43 per oz. for refined platinum and $45.50 for hard metal. The foreign market is reported strong.

Our Russian correspondent writes, under date of June 4, that the market is practically unchanged. From Ekaterinburg good sales are reported. Small producers have been pressing sales, in order to get money for their summer work, and the quotation is a shade lower, at 9.30 rubles per zolotnik—$34.97 per oz.—for crude metal, 83 per cent. platinum. In St. Petersburg 35,500 rubles per pood—$34.79 per oz.—is the quotation for the same grade.

Palladium—The supply of this rare metal seems to be insufficient for the small demand. The price has advanced sharply, from $43 to $49 per oz., within the past week.

Silver—The market is now awaiting news from the Monsoon. The uplift of another prosperous year in India would certainly have a tendency to improve the price of silver, other conditions being equal. Meantime trade is quiet.

SILVER AND STERLING EXCHANGE

June	8	9	10	12	13	14
New York	53¼	53	53	53⅛	53⅛	53⅛
London	24⅝	24½	24½	24⅝	24½	24½
Sterling Ex.	4.8575	4.8580	4.8585	4.8590	4.8590	4.8585

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Exports of silver from London to the East, Jan. 1 to June 1, as reported by Messrs. Pixley & Abell:

	1910	1911	Changes
India	£2,653,500	£3,863,800	I. £1,210,30
China	1,113,500	822,800	D. 290,700
Total	£3,767,000	£4,686,600	I. £ 919,600

India Council bills in London brought an average of 16d. per rupee for the week.

Sales of gold bars from the New York Assay Office in May were $2,530,508, against $2,085,458 in April and $2,215,970 in May, 1910. The gold is sold to jewelers and other manufacturers, and the increase shown was unexpected.

Copper, Tin, Lead and Zinc

NEW YORK

June	Copper: Lake, Cts. per lb.	Copper: Electrolytic, Cts. per lb.	Tin: Cts. per lb.	Lead: New York, Cts. per lb.	Lead: St. Louis, Cts. per lb.	Zinc: New York, Cts. per lb.	Zinc: St. Louis, Cts. per lb.
8	12¾ @12⅝	12 20 @12.25	47½	4.37½ 4.40	4.22½ @4.25	5.35 @5.40	5.20 @5 25
9	12⅝ @12⅝	12.20 @12.25	47¾	4.37½ 4.40	4.22½ @4.25	5.35 @5.40	5.20 @5.25
10	12¾ @12⅝	12.25 @12.30	47¾	4.37½ 4.40	4.22½ @4.25	5 35 @5.40	5.20 @5.25
12	12½ @12¾	12.30 @12.35	47	4.40 4.42½	4.25 @4.27½	5.37½ @5.42½	5.22½ @5.27½
13	12½ @12¾	12.35 @12.40	47	4.40 4.42½	4.25 @4.30	5.40 @5.45	5.25 @5.30
14	12½ @12¾	12.40 @12.45	46½	4.40 4.42½	4.25 @4.30	5.40 @5.45	5.25 @5.30

The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis New York, cash. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—Those believing in a better copper market have received a great deal of encouragement during the past week. In spite of previous large purchases, the appetite of the European consumer appears to be insatiable, and again a very heavy export business has taken place from day to day. Domestic consumers have not taken hold in a proportionate degree, being still doubtful of the genuineness of the movement. However, there are some exceptions, as in various quarters sales are reported for domestic delivery on a larger scale. It is generally recognized that outside of the leading interests there are no stocks of copper, and the inauguration of a definite movement on the part of consumers to stock up in their yards

LONDON

June	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
8	55 11/16	56¼	59½	212	190	13⅛	24⅛
9	55⅛	56 1/16	59½	222	189¾	13 3/16	24⅛
10	.....	.....	.....	.....	.....	.....	.....
12	56	56 3/16	60	231	190	13¼	24⅝
13	56⅛	56¾	60	230	188½	13¼	24⅝
14	56 7/16	57	60½	229	186¼	13¼	24⅝

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21¾c.

may quickly reduce the accumulation in the hands of the refiners. The improvement in sentiment already manifest has led the latter to advance their prices from day to day and buying has been well maintained at the advances. At the close the market for electrolytic had become fairly established on the basis of 12⅝c., delivered, usual terms, while the leading sellers of Lake had advanced their asking price to 12¾c. The close is firm at 12½@12¾c. for Lake copper, and 12.40@12.45c. for electrolytic copper in cakes, wirebars and ingots. Casting copper is quoted nominally at 12.15@12.30c. as the average for the week.

Copper sheets are 18@19c. base, for large lots. Full extras are charged and higher prices for small quantities. Copper wire is 13¾c. base, carload lots at mill. Business is improving. There are some reports of shading in prices of sheets.

The London standard market has been more active, but the speculation has not been of a volume proportionate to what might have been expected in view of the large absorption on part of European consumers. Prices are firm, and close at the highest, £56 8s. 9d. for spot, and £57 for three months.

Exports of copper from New York for the week were 7175 long tons. Our special correspondent gives the exports from Baltimore for the week at 1472 tons.

Brass Prices—The revised schedule just issued shows prices as follows: Sheet brass, high, 14c., low, 15⅜c.; brass wire, high, 14c., low, 15⅜c.; brass rods, high, 14c., low, 16⅛c.; brass tubing, brazed, 19⅛c., open-seam, 17⅛c. Scrap allowances, 8.6c. net for high brass, 9.5c. for low brass.

Tin—The corner of spot tin in London continues, and consequently prices show tremendous fluctuations. Future tin during the week has sold at a discount of as much as £44. In fact, tin for delivery late in June could be bought at some £20 below spot material. The spot situation in the New York market is not as acute as in London, for the reason that there is no speculation on this side and that consumers are at present buying just as little as possible. Besides, the so called impure brands of tin, which are being offered at a considerable discount from Straits, are gladly taken. Spot tin is selling here at about 3c. below the importation basis. The markets close at £229 for spot, and £186 5s. for three months in London, and about 46½c. for June tin in New York.

Messrs. Robertson & Bense report that receipts of tin ore and concentrates at Hamburg, Germany, in May were 1069 metric tons, all from Bolivia.

Official statement of tin exports from Federated Malay States, year 1910: Tin in metallic form, 11,097; tin in ore, 38,037; total, 49,134 short tons, equal to 43,870 long tons. As compared with 1909 the total shows a decrease of 4724 short tons.

Exports of tin from the Straits, three months ended March 31: United States, 4804; Great Britain, 6530; European continent, 1775; India, 371; China, 120; total, 13,600 long tons, an increase of 529 tons over last year.

Lead—There has been a very much better inquiry for this metal on the part of the general trade, and prices have crept upward. The close is firm at 4.40 @4.42½c., New York, and 4.25@4.30c., St. Louis.

The London lead market is keeping up under a large demand, particularly from the electrical industry, the close being cabled at £13 5s. for Spanish lead, and £13 7s. 6d. for English.

Spelter—It appears that in spite of the dull condition of the iron and steel business during the past few weeks very little spelter has accumulated in the hands of smelters, and when in sympathy with other metals the demand for spelter during the last few days assumed larger proportions, prices responded immediately, and the close is firm and higher at 5.40 @5.45c. New York, and 5.25@5.30c. St. Louis.

The London spelter market is reported as being extremely firm, and there exists in that quarter a great scarcity of nearby supplies. Quotations have advanced, and the close is cabled at £24 12s. 6d. for good ordinaries, and £24 17s. 6d. for specials.

Base price of zinc sheets $7.25 per 100 lb., f.o.b. La Salle-Peru, less 8 per cent. discount.

Silesian Spelter Market—Paul Speier writes from Breslau, Germany, that the market remains firm and consumption is apparently increasing. Prices have advanced slightly and quotations are 49.50 marks per 100 kg., f.o.b. works in Silesia—equal to 5.34c. per lb. for ordinary brands; 1 mark higher for specials. Zinc sheets are 57.85@59.85 marks per 100 kg., f.o.b. works—average equal to 6.35c. per lb. Zinc dust is quoted around 45.25 marks per 100 kg.—4.88c. per lb.—f.o.b. Stettin.

Other Metals

Aluminum—The market continues dull and heavy. Quotations are 19¾@20¼c. for No. 1 ingots, New York.

Antimony—A little more business is reported this week, but the market is rather uncertain. Cookson's is still held at 9c. per lb., but outside brands are up a shade, 7.35@7.65c. being named for Chinese and Hungarian.

Quicksilver—Demand continues good and supplies are still rather scarce. Prices have advanced a little. New York quotation is $44 per flask of 75 lb. San Francisco, $43.50@44 for domestic orders and $41@41.50 for export. London quotations are £8 10s. per flask, with £8 2s. named from second hands.

Bismuth—The current price of bismuth in London is 7s. 6d.—or $1.80—per pound.

Cadmium—Paul Speier writes from Breslau, Germany, that cadmium is in good demand, and is quoted at 725@750 marks per 100 kg.—equal to 78.3@81c. per lb.—according to size of order.

Magnesium—The price of pure metal is $1.50 per lb. for 100-lb. lots, f.o.b. New York.

Nickel—Large lots, contract business, 40@50c. per lb. Retail spot, from 50c. for 500-lb. lots up to 55c. for 200-lb. lots. The price of electrolytic is 5c. higher.

Zinc and Lead Ore Markets

Platteville, Wis., June 10—The base base price paid this week for 60 per cent. zinc ore was $39. The base price paid for 80 per cent. lead ore was $54 per ton.

SHIPMENTS, WEEK ENDED JUNE 10

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville	922,770	.....	377,500
Mineral Point	810,640	.....	.....
Hazel Green	328,620	.....	.....
Highland	318,300	.....	.....
Harker	290,290	.....	.....
Galena	249,900	.....	.....
Bewey	81,000	.....	.....
Linden	63,240	.....	80,000
Dodgeville	60,000	.....	.....
Cuba City	.....	.....	245,370
Benton	.....	.....	86,000
Livingston	50,000	.....	.....
Total	3,174,760	.....	788,870
Year to date	63,721,400	3,787,325	15,566,160

Shipped during week to separating plants, 1,711,650 lb. zinc ore.

Joplin, Mo., June 10—The high price for zinc sulphide ore was $43, the base ranging from $37 to $40 per ton of 60 per cent. zinc. Zinc silicate sold on a base of $19@21 per ton of 40 per cent.

zinc. The average price, all grades of zinc, was $36.30. Rumor had it that 440,000 lb. of lead was sold at $60. This was founded on a statement early in the week by the mine manager that he would not accept less than $60, but the buyer disclaims having paid over $59 for any ore. The average price, all grades of lead, was $55.32 per ton.

Development work northwest of Joplin is recording new ore discoveries over a wide range of territory from there to Carl Junction. New developments and the reopening of old mines in and about Calena are swelling shipments over the State line. Some of the older camps are outputting less.

SHIPMENTS, WEEK ENDED JUNE 10

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville.	3,806,940	.....	831,850	$95,206
Joplin.....	1,835,520	.....	302,640	44,573
Duenweg.....	604,010	.....	444,250	24,137
Galena.....	963,520	.....	158,530	22,665
Alba-Neck....	501,620	.....	.....	10,032
Miami.....	470,220	.....	127,580	9,348
Granby.....	73,970	470,100	12,640	6,915
Spring City..	75,840	328,150	59,680	6,479
Oronogo.....	190,530	.....	69,100	5,351
Jackson.....	232,260	.....	18,380	4,693
Aurora.....	210,030	63,950	.....	4,420
Carl Junction	155,440	.....	.....	3,185
Stott City.....	124,020	.....	.....	2,356
Sarcoxie.....	88,820	.....	.....	1,687
Cave Springs.	64,600	.....	.....	1,227
Totals.....	9,397,340	862,100	2,024,650	$242,274
23 weeks....	226,987,150	15,109,430	39,079,380	$5,712,178
Blende val., the week,		$176,582;	23 weeks,	$4,449,598
Calamine, the week,		9,685;	23 weeks,	176,931
Lead value, the week,		56,007;	23 weeks,	1,085,649

MONTHLY AVERAGE PRICES

Month	Zinc Ore				Lead Ore	
	Base Price		All Ores		All Ores	
	1910	1911	1910	1911	1910	1911
January.....	$47.31	$41.85	$45.16	$40.55	$56.99	$55.68
February....	40.69	40.21	39.47	39.16	53.64	54.46
March.....	43.60	39.85	39.71	38.45	51.26	54.77
April.....	41.00	38.88	39.33	37.47	49.72	56.37
May.....	40.19	38.25	37.51	36.79	48.16	55.21
June.....	40.20	.....	37.83	.....	48.80	.....
July.....	39.63	.....	36.80	.....	48.59	.....
August.....	40.13	.....	37.32	.....	49.75	.....
September..	43.45	.....	39.96	.....	54.73	.....
October.....	43.31	.....	40.50	.....	53.18	.....
November...	47.20	.....	43.20	.....	54.80	.....
December....	42.50	.....	40.70	.....	55.70	.....
Year.....	$42.43	.....	$39.79	.....	$52.12	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

CHEMICALS

New York, June 14—The general trade is fairly steady, but still rather quiet.

Copper Sulphate—Demand is pretty good and supplies are not plentiful. Quotations are firm at $4.50@4.75 per 100 lb. for carload lots.

Arsenic—The market remains quiet, with small sales. Quotations are unchanged at $1.50@1.62½ per 100 lb. for white arsenic.

Nitrate of Soda—Business is fair and prices unchanged, at 2.10c. per lb. for spot, and 2.12½c. for future positions.

Petroleum

The petroleum production of Rumania in April was 111,000 metric tons. Exports from Rumania for the quarter ended March 31 were: Crude oil and residium, 24,475 metric tons; refined oil, 74,803; benzine, 27,455; paraffin wax, 142; total, 126,875 tons, an increase of 15,857 tons over last year.

Production and deliveries of petroleum in various fields in May, with stocks on May 31, are reported by the *Oil City Derrick* as follows, in barrels of 42 gal. each:

Fields:	Production	Deliveries	Stocks
Eastern.....	2,561,886	5,804,816	15,549,079
Illinois.....	2,299,881	1,131,231	24,129,388
Oklahoma & Kan.	4,868,093	4,590,813	53,177,261

The Eastern fields include New York, Pennsylvania, West Virginia, Ohio, Indiana and Kentucky. The figures are based on pipeline reports.

Petroleum production in California in April is reported by the *Oil World* as follows: San Joaquin valley, 4,945,150; Coast region, 705,326; Southern fields, 892,652; total, 6,543,128 bbl., an increase of 201,525 bbl. over March.

MINING·STOCKS $

New York, June 14—The general stock market has been rather quiet, almost dull; but no special weakness has developed, and prices have held well, with only small fluctuations. Much interest was shown in those copper stocks that are listed on the Exchange, and their prices generally advanced. There is not much outside interest manifest.

One sale of Homestake was reported, 100 shares at $85.25 per share.

The Curb has also been rather quiet, with only a small interest felt and rather narrow trading. Among mining stocks the coppers were stronger and most active. Cobalt shares were slow, and other mining shares made little show.

Boston, June 13—Mining shares have been fairly active the past week and apparently there is a little more public interest in them. Prices were shaded at times on profit-taking but quickly came back with the appearance of buying orders. There have been quite a number of active issues, but these were largely the result of pool operations. The strength of Amalgamated, Smelters and Utah Copper in the New York market has encouraged holders of copper stocks.

Especially active aside from Amalgamated, which rose $2.12½ to $69.25, have been Arizona Commercial, Franklin, Copper Range, East Butte, Giroux, Hancock, Lake, North Lake and Old Dominion. U. S. Smelting issues and American Zinc have also been strong and active. The common stock of the first named rose $2 during the week and Zinc rose almost $2. Hancock took a sudden burst of activity and strength early in the week and shot up $5.62½ per share.

The Old Colony Copper Company has levied an assessment of $1 per share, payable June 26 to carry on further de-

COPPER PRODUCTION REPORTS

Copper contents of blister copper, in pounds

Company	March	April	May
Anaconda.....	21,900,000	21,500,000	.....
Arizona, Ltd.....	3,094,000	2,840,000	2,800,000
Balaklala	866,670	880,921	.....
Copper Queen.....	7,333,629	6,933,422	.....
Calumet & Ariz....	1,960,000	3,850,000	3,854,000
Detroit.....	1,914,710	1,814,740	.....
East Butte.....	1,120,000	1,085,000	.....
Imperial.....	.....	.....	.....
Nevada Con.....	5,632,259	5,298,632	.....
Old Dominion.....	2,563,000	2,535,000	2,363,000
Shannon.....	1,322,000	1,258,000	.....
South Utah.....	300,007	300,137	318,350
Superior & Pitts.†..	2,540,000	.....	.....
United Verde*.....	3,000,000	2,500,000	3,000,000
Utah Copper Co....	7,260,267	8,169,248	.....
Lake Superior*....	20,000,000	16,000,000	19,000,000
Non-rep. mines*...	12,224,993	11,825,000	13,280,000
Total production.	93,031,535	86,790,100	.....
Imports, bars, etc..	24,345,814	25,655,122	.....
Total blister.....	117,377,349	112,445,222	.....
Imp. in ore & matte	6,126,650	5,207,484	.....
Total.....	123,503,999	117,652,706	.....
Brit. Col. Cos.:			
British Col. Copper	804,542	952,284	.....
Granby	1,988,341	1,825,340	.....
Mexican Cos.:			
Boleo.....	2,700,880	2,403,520	2,411,500
Cananea	3,542,000	3,644,000	4,098,000
Moctezuma	2,049,150	2,315,292	.....
Exports from:			
Chile.....	7,168,000	5,152,000	7,392,000
Australia	9,632,000	5,936,000	11,088,000

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners.

*Estimated.

†From April the Superior & Pittsburg production is included with Calumet & Arizona.

STATISTICS OF COPPER

Month.	United States Product'n.	Deliveries, Domestic.	Deliveries, for Export
V, 1910.....	123,242,476	59,305,222	45,495,400
VI.....	127,219,188	53,363,196	65,895,948
VII.....	118,370,003	56,708,175	59,407,167
VIII.....	127,803,618	67,731,271	61,831,780
IX.....	119,519,983	64,501,018	75,106,496
X.....	126,469,284	67,814,172	68,186,912
XI.....	119,353,463	60,801,992	67,424,316
XII.....	123,339,219	43,594,018	88,104,075
Year 1910....	1,452,122,120	749,426,542	722,431,494
I, 1911.....	115,696,591	42,078,567	53,208,739
II.....	109,828,297	50,518,998	45,111,019
III.....	130,532,080	66,080,789	59,081,127
IV.....	118,085,223	52,407,650	62,120,599
V.....	126,962,544	64,543,963	61,978,557

	Visible Stocks.		
	United States.	Europe.	Total.
VI, 1910.....	160,425,973	239,142,400	399,568,378
VII.....	168,386,017	232,892,800	401,278,817
VIII.....	170,640,678	222,320,000	392,960,675
IX.....	168,881,245	218,444,800	387,326,046
X.....	148,793,714	211,276,800	360,070,519
XI.....	139,261,914	198,060,800	337,322,711
XII.....	130,389,069	193,200,000	323,589,095
I, 1911.....	122,030,195	236,629,120	358,649,373
II.....	142,439,490	236,992,000	379,431,134
III.....	156,637,770	233,385,600	390,023,009
IV.....	162,007,934	223,014,400	385,022,434
V.....	165,555,908	212,284,800	377,840,708
VI.....	165,995,932	202,540,800	368,536,732

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month. From Jan. 1, 1911, stocks at Hamburg and Rotterdam are included in the visible stocks for Europe.

velopment work. The Copper Range Consolidated announces that over 70 per cent. of the Atlantic stock has been turned in for exchange into Copper Range stock.

There has been considerable activity on the Curb. Hollinger spurted over $2 to $14.75. United Verde Extension took a downward dip to 95c. and Rhode Island Coal has also been heavy.

Assessments

Company	Delinq	Sale	Amt
Caledonia, Nev.	June 2	June 21	$0.10
Carney Copper, Ida.	May 15	June 25	0.004
Clear Grit, Ida.	June 9	July 6	0.002½
Con. Virginia, Nev.	June 14	July 5	0.25
Copper King, Ida.	May 15	June 15	0.01
Dennemora, Ida.	June 26	July 26	0.002
East Hercules Extens'n, Id.	June 19	July 19	0.001
Imperial, Ida.	May 17	June 17	0.005
Mass, Mich.	June 15	.....	2.00
Missoula Copper, Ida.	June 5	July 19	0.01
Mountain Dell, Utah.	May 31	June 16	0.02
New York-Bonanza, Utah.	June 8	June 29	0.02
Nine Mile, Ida.	June 25	July 30	0.001
North Star, Ida.	May 15	June 15	0.001
Old Colony, Mich.	June 26	.....	1.00
Overman, Nev.	May 17	June 7	0.05
Reindeer, Ida.	June 1	July 1	0.005
Rockford, Ida.	June 6	July 6	0.001
Silver Shield, Utah.	May 16	June 3	0.015
Smuggler, Utah	May 20	June 20	0.005
Snowstorm Extension, Ida.	June 22	July 24	0.003
Temple, Ida.	June 27	July 26	0.002
Trans.-Continental, Ida.	June 30	July 22	0.002
Utah Consolidated, Utah.	May 20	June 10	0.01
Utah United Copper, Utah.	June 24	.....	0.01
Wonderful, Ida.	May 22	July 10	0.001

Monthly Average Prices of Metals

SILVER

Month.	New York.			London.		
	1909.	1910.	1911.	1909.	1910.	1911.
January	51.750	52.375	53.795	23.843	24.154	24.865
February	51.472	51.534	52.222	23.706	23.794	24.081
March	50.468	51.454	52.745	23.227	23.690	24.324
April	51.428	53.221	53.325	23.708	24.483	24.595
May	52.905	53.870	53.308	24.343	24.797	24.583
June	52.538	53.462	.....	24.166	24.651	.....
July	51.043	54.150	.....	23.519	25.034	.....
August	51.125	52.912	.....	23.588	24.428	.....
September	51.440	53.295	.....	23.743	24.567	.....
October	50.923	55.490	.....	23.502	25.596	.....
November	50.703	55.635	.....	23.351	25.680	.....
December	52.226	54.428	.....	24.030	25.160	.....
Total	51.502	53.486	.....	23.706	24.670	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	New York.				London, Standard.	
	Electrolytic		Lake.			
	1910.	1911.	1910.	1911.	1910.	1911.
January	13.620	12.295	13.870	12.680	60.923	55.604
February	13.332	12.256	13.719	12.611	59.388	54.970
March	13.255	12.139	13.586	12.447	59.214	54.704
April	12.733	12.019	13.091	12.275	57.238	54.035
May	12.550	11.990	12.885	12.214	56.313	54.313
June	12.404	.....	12.798	.....	55.310	.....
July	12.215	.....	12.570	.....	54.194	.....
August	12.490	.....	12.715	.....	55.733	.....
September	12.379	.....	12 668	.....	55.207	.....
October	12.553	.....	12.788	.....	56.722	.....
November	12.742	.....	12.914	.....	57.634	.....
December	12.581	.....	12.863	.....	56.769	.....
Year	12.738	.....	13.039	.....	57.054	.....

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

TIN AT NEW YORK

Month.	1910.	1911.	Month.	1910.	1911.
January	32.700	41.255	July	32.695	.....
February	32.920	41.614	August	33.972	.....
March	32.403	40.157	September	34.982	.....
April	32.976	42.185	October	36.190	.....
May	33.125	43.115	November	36.547	.....
June	32.769	.....	December	38.199	.....
			Av. Year	34.123	.....

Prices are in cents per pound.

LEAD

Month.	New York.		St. Louis.		London.	
	1910.	1911.	1910.	1911.	1910.	1911.
January	4.700	4.483	4.582	4.334	13.650	13.009
February	4.613	4.440	4.445	4.266	13.328	13.043
March	4.459	4.394	4.307	4.238	13.063	13.122
April	4.376	4.412	4.225	4.262	12.641	12.889
May	4.315	4.373	4.164	4.223	12.550	12.984
June	4.343	....	4.207	.....	12.688	.....
July	4.404	.....	4.291	.....	12.531	.....
August	4.400	.....	4.290	.....	12.513	.....
September	4.400	.....	4.289	.....	12.582	.....
October	4.400	.....	4.271	.....	13.091	.....
November	4.442	.....	4.314	.....	13.217	.....
December	4.500	.....	4.363	.....	13.197	.....
Year	4.446	.....	4.312	.....	12.920	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York.		St. Louis.		London.	
	1910.	1911.	1910.	1911.	1910.	1911.
January	6.101	5.452	5.951	5.302	23.350	23.887
February	5.569	5.518	5.419	5.368	23.188	23.276
March	5.637	5.563	5.487	5.413	23.031	23.016
April	5.439	5.399	5.289	5.249	22.469	23.743
May	5.191	5.348	5.041	5.198	22.100	24.375
June	5.128	.....	4.978	.....	22.094	.....
July	5.152	.....	5.002	.....	22.406	.....
August	5.279	.....	5.129	.....	22.800	.....
September	5.514	.....	5.364	.....	23.165	.....
October	5.628	.....	5.478	.....	23.900	.....
November	5.976	.....	5.826	.....	24.083	.....
December	5.624	.....	5.474	.....	24.019	.....
Year	5.520	.....	5.370	.....	23.050	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG.

	Bessemer		Basic		No. 2 Foundry	
	1910	1911	1910	1911	1910	1911
January	$19.90	$15.90	$17.98	$14.40	$17.94	$14.75
February	18.96	15.90	17.21	14.50	17.38	14.81
March	18.53	15.90	16.93	14.65	17.00	14.96
April	18.28	15.90	16.84	14.65	16.75	15.00
May	17.10	15.90	15.94	14.30	16.18	14.72
June	16.52	.....	15.60	.....	15.53	.....
July	16.40	.....	15.40	.....	15.40	.....
August	16.09	.....	14.89	.....	15.16	.....
September	15.92	.....	14.73	.....	14.93	.....
October	15.90	.....	14.05	.....	14.88	.....
November	15.84	.....	14.26	.....	14.78	.....
December	15.90	.....	14.15	.....	14.65	.....
Year	$17.10	.....	$15.65	.....	$15.83	.....

STOCK QUOTATIONS

COLO. SPRINGS June 13

Name of Comp.	Bid.
Acacia	‡.03½
Cripple Cr'k Con.	‡.01
C. K. & N.	‡.10
Doctor Jack Pot.	.05
Elkton Con.	.57
El Paso	.50
Findlay	.03
Gold Dollar	.11
Gold Sovereign	‡.02½
Isabella	.09⅜
Jack Pot	.04½
Jennie Sample	.09½
Lexington	‡.01
Moon Anchor	‡.02½
Old Gold	.02½
Mary McKinney	.31½
Pharmacist	‡.01
Portland	.96
Vindicator	.80
Work	‡.02

SALT LAKE June 13

Name of Comp.	Bid.
Beck Tunnel	.32½
Black Jack	.14
Carisa	.15
Cedar Talisman	.06
Colorado Mining	.53
Columbus Con	.46
Daly Judge	‡4.45
Grand Central	.73
Iron Blossom	1.32½
Little Bell	.46
Lower Mammoth	.10½
Mason Valley	9.00
May Day	.13½
Nevada Hills	3.10
New York	‡.12
Prince Con	.74
Silver King Coal'n	1.50
Sioux Con	.33½
Uncle Sam	.69
Yankee	‡.17½

TORONTO June 13

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	6.50	Porcu. Tisdale	.10
Hudson Bay	.90	Pearl Lake	.56
Temiskaming	.64	Dobie	2.75
Wettlaufer-Lor.	1.19	West Dome	1.85
Apex.	.14	Standard	.18
Central	.84	Preston E. D.	.34½
Dome Exten.	.65	Canada	‡1.12
Hollinger	15.50	Rea	6.17
Imperial	.18	Coronation	.35
Porcu. Gold	.60	Swastika	.60

SAN FRANCISCO June 13

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.06	Belmont	6.20
Belcher	.73	Jim Butler	.22
Best & Belcher	.50	MacNamara	.12
Caledonia	.53	Midway	.16
Challenge Con.	.18	Mont.-Tonopah	.77
Chollar	.18	North Star	.14
Confidence	.50	West End Con.	.45
Con. Virginia	1.45	Atlanta	.10
Crown Point	.70	Booth	.07
Gould & Curry	.23	C.O.D. Con	.08
Hale & Norcross	.24	Comb. Frac	.07
Mexican	4.42½	Jumbo Extension	.27
Occidental	.65	Oro	.04
Ophir	2.02	Silver Pick	.04
Overman	.45	St. Ives	‡.10
Potosi	.30	Tramps Con	‡.02
Savage	.29	Argonaut	1.75
Sierra Nevada	.55	Bunker Hill	‡7.12
Union Con.	1.42½	Cent. Eureka	1.00
Yellow Jacket	.30	So. Eureka	‡7.00

N. Y. EXCH. June 13

Name of Comp.	Clg.
Amalgamated	70⅝
Am. Agri. Chem.	59¼
Am.Sm.&Ref.,com	83¼
Am. Sm.& Ref., pf.	106¾
Anaconda	41⅛
Batopilas Min	2.15
BethlehemSteel pf	62½
Chino	24
Comstock Tunnel	‡.29
Federal M.& S., pf.	64½
Goldfield Con.	6⅜
Great Nor., ore ctf.	62⅞
Homestake	85¼
Miami Copper	20⅝
Nat'nalLead,com.	57⅜
National Lead, pf.	107½
Nev. Consol	20½
Pittsburg Coal, pf.	86⅞
Ray Con	18
RepublicI&S,com	30
Republic I & S, pf.	95½
SlossSheffi'd,com.	49⅞
Sloss Sheffield, pf.	‡112
Tennessee Copper	44
Utah Copper	51¼
U. S. Steel, com.	78⅛
U. S. Steel, pf.	118¼
Va. Car. Chem.	59¼

N. Y. CURB June 13

Name of Comp.	Clg.
Ariz.-Cananea	‡3⅜
Barnes King	‡.15
Braden Copper	4¾
B. C. Copper	5½
Buffalo Mines	1.85
Butte Coalition	.20
Calumet & Mont.	‡.20
Cobalt Central	.02
Con. Ariz. Sm.	1⅝
Davis-Daly	1⅞
Ely Con	⅛
Florence	1⅛
Giroux	7⅛
Greene Cananea	7¼
Greenwater	.07
Guanajuato	‡3¼
Guerrero	‡1⅛
Guggen. Exp.	205
Inspiration	9
Internat. S. & R.	124
Kerr Lake	5⅞
La Rose	4⅝
McKinley-Dar-Sa.	13¾
Min. Co. of A. new	5¼
Moneta Porc.	‡.16
Mont Shoshone	‡.04
Nev. Utah M. & S.	¾
Nipissing Mines	10½
Ohio Copper	1⅛
Pacific Sm. & M.	⅛
Precious Metals	‡⅛
Ray Central	1¾
Red Warrior	‡1½
South Utah M. & S.	1
Standard Oil	655
Stewart	1
Tonopah	5⅛
Tonopah Ex.	.99
Tri-Bullion	⅛
Tularosa	‡½
Union Mines	‡⅞
Yukon Gold	4

LONDON June 14

Name of Com.	Clg.
Camp Bird	£1 10s 6d
Dolores	1 10 0
El Oro	1 4 6
Esperanza	1 10 6
Mexico Mines	8 1 0
Oroville	0 6 9
Stratton'sInd.	0 2 3
Tomboy	0 15 6

BOSTON EXCH. June 13

Name of Comp.	Clg.
Adventure	7
Algomah	10⅝
Allouez	32⅞
Am. Zinc	30½
Arcadian	3¾
Arizona Com.	18¾
Atlantic	6
Bonanza	.60
Boston & Corbin	15
Butte & Balak	4⅞
Calumet & Ariz.	62¾
Calumet & Hecla	470
Centennial	12½
Con. Mercur	.07
Copper Range	61½
Daly-West	6
East Butte	13⅞
Franklin	13¾
Granby	39¾
Hancock	29¾
Hedley Gold	‡15
Helvetia	1⅜
Indiana	15¼
Isle Royale	19
Keweenaw	2¼
Lake	40
La Salle	4
Mass	6½
Michigan	2½
Mohawk	50
New Arcadian	4
North Butte	35¾
North Lake	9¼
Ojibway	7
Old Dominion	49
Osceola	106
Parrot	12⅞
Quincy	71
Shannon	11¼
Shattuck-Ariz.	19
Superior	34½
Superior & Bost.	7⅜
Superior & Pitts.	18
Tamarack	37
Trinity	4⅝
U. S. Smelting	39⅜
U. S. Smelt'g, pf.	49
Utah Apex	3¼
Utah Con.	19½
Victoria	1¾
Winona	8¼
Wolverine	112
Wyandot	1¼

BOSTON CURB June 13

Name of Comp.	Last
Ahmeek	170
Bingham Mines	1½
Boston Ely	1⅛
Boswyocolo	.07½
Cactus	.12
Calaveras	1½
Champion	‡.01
Chief Cons	1⅛
Corbin	2½
Cortez	1⅛
Crown Reserve	3½
First Nat. Cop.	1½
Live Oak	20
Majestic	.62
Mazatan	1
Nat'l Mine & Ex.	.22
Nevada-Douglas	2⅞
Oneco	2½
Raven Copper	.27
Rhode Island Coal	27
San Antonio	‡3½
South Lake	7⅛
Trethewey	1.03
Tuolumne Copper	‡4½
United Zinc, pfd.	‡2
Vulture	6
Yuma	‡.02

‡Last quotation.